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NEW BRUNSWICK OIL SHALE: TECHNOLOGICAL CHARACTERIZATION AND PETROSIX PILOT PLANT RETORTING TESTS

by

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NEW BRUNSWICK OIL SHALE:
TECHNOLOGICAL CHARACTERIZATION AND
PETROSIX PILOT PLANT RETORTING TESTS

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NEW BRUNSWICK OIL SHALE

TECHNOLOGICAL CHARACTERIZATION

AND

PETROSIX PILOT PLANT RETORTING TESTS

TECHNICAL REPORT

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NEW BRUNSWICK OIL SHALE

TECHNOLOGICAL CHARACTERIZATION

AND

PETROSIX PILOT PLANT RETORTING TESTS

TECHNICAL REPORT

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ABSTRACT

This report presents the principal results obtained for the technological characterization and Pilot Plant retorting tests made on two samples of New Brunswick Albert Formation oil shale.

The tests were contracted by the New Brunswick Department of Natural Resources and Energy, Energy Branch through Stone & Webster Engineering Corporation for the purpose of making a preliminary appraisal of the applicability of the PETROSIX Process to handle representative quantities of the Albert Mines Zone and Dolomite Marlstone Zone shales.

The results obtained demonstrate that both oil shales can be processed by the PETROSIX Process, but due to the higher thermal degradation of the Albert Mines Zone sample, the Pilot Plant tests indicate that the recommended processing rate may be only 2000 kg/hm2. Little difficulty was encountered in attaining a feed rate of 2700 kg/hm2 for the Dolomite Marlstone Zone sample.

ACKNOWLEDGEMENTS

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NEW BRUNSWICK OIL SHALE

TECHNOLOGICAL CHARACTERIZATION

AND

PETROSIX PILOT PLANT

RETORTING TESTS

TECHNICAL REPORT

CHAPTER 1 - INTRODUCTION

CHAPTER 1 - INTRODUCTION

PETROBRAS developed a retorting process, known as the PETROSIX Process, for obtaining oil and gas from oil shale and has been operating as a semi-commercial plant at Sao Mateus do Sul, Parana, Brazil for more than 16 years.

Experience has been accumulated during this period of continuous and directed efforts towards the consolidation of this oil shale retorting technology, as well as the other lines of research aimed at the full utilization of the shale and make possible the application of this knowledge to shales of other origins.

In order to evaluate the feasibility of the PETROSIX Process for retorting foreign oil shales, PETROBRAS has proposed a staged program with the following steps:

- Technological characterization of the oil shale;
- Pilot plant retorting test;
- Preliminary design and a preliminary cost estimate of an industrial size plant;
- Demonstration plant tests;
- Industrial plant design, construction and operation.

The actual number of stages to be performed will depend on the client's needs, the problems found and the available time.

New Brunswick Department of Mineral Resources and Energy (NB), assisted by Stone and Webster Engineering Corporation, decided to evaluate the feasibility of the PETROSIX Process for retorting New Brunswick oil shales. The testing program agreed between PETROBRAS and these two firms comprised the first two stages of the experimental program presented above and the preparation of a report summarizing the main results of the PETROSIX Pilot Plant test, as well as recommendations about the New Brunswick oil shale.

In the second chapter, the report discusses the characterization of two New Brunswick oil shale samples received for the Pilot Plant tests. They were identified as representative of the Albert Mines Zone and the Dolomite Marlstone Zone. The characterization step consists of several laboratory tests to define the more important physical and chemical properties of the shale.

Chapter 3 presents the Pilot plant tests results, including process conditions, laboratory analyses, mass balance, elemental (Carbon, hydrogen and sulfur) and heat balances and process yields, as well as comments on the behavior of the two New Brunswick oil shale samples in the PETROSIX Pilot retort.

In chapter 4 is presented the more important conclusions drawn from the New Brunswick oil Shale testing program and the recommendations about the next steps necessary to complete the evaluation of PETROSIX Process for these shales.

NEW BRUNSWICK OIL SHALE

TECHNOLOGICAL CHARACTERIZATION

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CHAPTER 2 - CHARACTERIZATION ASSAYS

2.1 PURPOSE

This chapter concerns the characterization assays made on the two samples of New Brunswick oil shale provided by Three-D Geoconsultants Ltd - Canada. The samples were identified as representative segments of the Albert Mines Zone and the Dolomite Marlstone Zone.

The assays are based on laboratory analyses performed on samples collected from the original samples, after crushing and screening operations, prior to the Pilot plant tests.

These assays were conducted to obtain physical and chemical data that help to estabish operational conditions for the retorting tests and also to forecast the oil shale behaviour during handling and retorting operations.

The data acquired are useful for further interpretation of the results from retorting tests and also for setting up the design basis for the industrial plant evaluation.

2.2 SAMPLES TREATMENT AND HANDLING

The two samples received were in 30 steel drums, weighing aproximately 2500 kg for the Albert Mines Zone sample and 3700 kg for the Dolomite Marlstone Zone sample.

The shale particles were in the size range from zero to aproximately ten inches. The drums were separated according to Three-D Geoconsultants Ltd identification and handled as two gross samples. As a reference, we reproduce in chapter 5 the letters and the laboratory results received about the samples. Both samples contained high moisture content and it was decided to subject them to air-drying for three days before proceeding to Pilot retort charge preparations.

The procedures for the preparation and sampling were identical for the two samples of New Brunswick shale.

The samples were handled separately in the charge preparation for the tests in the PETROSIX Pilot Plant. Figures 2.1 and 2.2 present flow diagrams of the operations and assays performed, as well as the weights involved.

First, the material corresponding to each of the samples was crushed in a single roll crusher, for top size reduction from 10 to 3/4 inch. The samples were separated into the granulometric ranges + 1/2" - 3/4", + 1/4" - 1/2" and the fines smaller than 1/4".

During the screening small portions from each of the ranges were taken to make representative samples for the characterization assays (more specifically the assays required to evaluate the mechanical strength of the shale).

Knowing the weights corresponding to each of the size fractions + 1/2 - 3/4" and + 1/4 - 1/2", the fractions were combined in a proportion to produce charges for the pilot plant with permeability adequate to the desired operational conditions.

Regarding this, it should be pointed out that, due to the limited amount of material for each of the ranges and having an objective to perform as many tests as possible in the pilot plant, the ranges were mixed in the proportion of about 65 and 35% weight respectively for the ranges + 1/2 - 3/4" and + 1/4 - 1/2. This resulted in charges with relatively low permeability indices.

The procedure utilized for the homogenezation of the two fractions that make up the charge to the retort, consisted in the formation of a long pile, placing alternate layers of the two ranges.

After completing this operation, the material was taken from one end of the pile. During this operation, small increments were collected, to make the sample of the retort charge, which was utilized for the other characterization assays and laboratory assays, as shown in figures 2.1 and 2.2.

2.3 CHARACTERIZATION ASSAYS

The methods used in the characterization assays are standard ASTM methods, which at times were modified to make them suitable for new uses. In the appendix, the methods used are indicated and also the modifications.

The Modified Fischer assay retorts are electrically heated and controlled to follow the ASTM D-3904-80 heating curve. The sample weight for this test was about 50 g instead of 100 g as fixed by the ASTM method.

The Fischer retort was also adapted to provide the samples of gas and the spent shale lumps. The gases were collected in one-way polyethylene bags at atmospheric conditions and the composition was immediately determined by chromatographic analysis, expressed on an air and water-free basis.

For the thermogravimetry analysis (TGA) the equipment used was a DUPONT model 9900. The assays were run only under nitrogen atmosphere and a temperature rate of 20 C/minute.

The mechanical strength of raw shale was evaluated by the Los Angeles test modified by PETROBRAS as described in section 5.2. over two specified granulometric ranges. This assay serves to indicate the resistance of shale lumps to abrasion by use of the Los Angeles Machine, and consequently gives an indication of the behavior of the tested material during handling and retort feeding.

The thermal degradation of retorted shale lumps was evaluated by visual observation after the sample was removed from the Fischer assay retort. This assay was performed at several temperatures. If the retorted shale presents no evidence of grain thermal thermal degradation, it is classified as "none". Otherwise, if the sample shows some kind of thermal degradation, it is classified as "small", "moderate" or "large" according to the intensity of this phenomenon.

The mechanical strength of retorted shale was evaluated by the modified tumbler test, using the retorted shale lumps obtained from the Fischer assay following the ASTM heating curve. The method serves to indicate the relative extent to which retorted shale will undergo size degradation from gravitational flow through the retort and discharge mechanism. Samples showing thermal degradation result in higher values in the tumbler test results. Before testing, raw shale samples were classified into definite granulometric ranges and retorted in the Fischer retort. The total retorted shale charge was then subjected to tumbling operation and again it was screened in order to determine the resulting size ranges. The degradation intensity is reported as friability percentage. Also, the dust index is calculated from this modified tumbler test.

The particle shape factor, expressed as sphericity, is a required parameter for pressure drop correlation. It was measured using a method that takes into account the three basic dimensions of the particles for each size fraction. The characteristic dimensions and the particle shape allows a calculation for the mean sphericity based on the granulometric sample distribution.

The modified permeability test was used as a method to evaluate the particle shape factor influences on the pressure drop in the raw shale bed. The test gives information about the particles orientation and the bed average porosity. A brief description of the method is given in the appendix.

The adhered fines index is a number that indicates the percentage of fine particles less than 1.7 mm that are present on the coarse particle surfaces.

This test gives data about fines carried into the retort by the charge. The fines are removed by cleaning the coarse sample (above 1/4 inch) and then oven drying and weighing the sample.

2.4 RESULTS

The physical and chemical data obtained for the raw and retorted Albert Mines Zone and Dolomite Marlstone Zone samples are presented in tables and figures at the end of this chapter.

The physical criteria such as granulometric distribution, adhered fines index and permeability tests were obtained from assays. Relative density which is made on individual lumps, required at least ten samples. Bulk density analyses and the tumbler test were run two times and the Los Angeles test was run three times on each size fraction.

Data obtained from chemical analyses express the average of two assays, with exception of moisture analysis, particle thermal degradation and shale ash analyses were run once, and Fischer assays, were run eight times.

Figure 2.1 and 2.2 show schematically samples preparation and assays performed, respectively for the Albert Mines Zone and Dolomite Marlstone Zone.

Tables 2.1 to 2.4 present the physical and chemical data for raw shale, retorted shale and shale ash.

Tables 2.5 and 2.6 present the gases composition on an air and water-free basis and elemental shale oil analyses obtained from the Fischer Assay.

For comparison purposes, figures 2.3 and 2.4 show some important physical and chemical properties of the two New Brunswick oil shale samples compared to properties of Irati oil shale. The ranges shown in the figures correspond to shales already retorted by the PETROSIX Process.

Figures 2.5 and 2.6 show the TGA analyses for both New Brunswick samples.

2.5 DISCUSSION OF RESULTS

As commented in section 2.2, both samples as received had a high superficial moisture content, considerable fines particles, and also mud adhered to the shale blocks.

The samples had a different visual aspect for the two materials. The Albert Mines Zone could be distinguished by its lamellar characteristics and a yellowish color for the particles of smaller size, indicating shale weathering.

Drying with air at ambient temperature was necessary before the crushing operation, due to the difficulties foreseen in the screening of the material at those conditions.

Because the moisture was superficial, air drying was quite efficient, as shown by the values obtained, releasing almost all of the adhered fine material.

The mechanical strength of the raw shale for both samples, determined by the Los Angeles assay and also by the minus 1/4" fines generation during crushing, showed results similar to those obtained for the Irati oil shale, as can be seen in figures 2.3 and 2.4. The values found were very near for the + 1/4 - 1/2" range and slightly more resistent than Irati shale for the + 1/2 - 3/4" range.

As expected from the appearance of the rock, the sample of Dolomite Marlstone Zone appeared to be more resistent than the Albert Mines Zone in the abrasion assays. The higher minus 1/4" fines content after crushing for the sample of Dolomite Marlstone was due to its greater content before crushing (see table 2.1).

The other raw shale properties, such as apparent density, particle sphericity, bulk density and adhered fines showed values within the range of samples previously tested by the PETROSIX Process.

The permeabilities obtained for the retort charges, were relatively low. This property was even lower for the Albert Mines Zone sample due to smaller particle sphericity which affects pressure drop in the bed.

In the retorting operation there were differences in behaviour between the two shale samples. The Albert Mines Zone sample showed a greater thermal degradation than the Dolomite Marlstone Zone sample. The Albert Mines Material, after retorting, showed a great number of fractures in the direction of the plane of rock deposition, which favoured the liberation of lamellae and contributed to fines generation.

The mechanical strength of the retorted shale evaluated by the tumbler test showed similar values for both samples (figures 2.3 and 2.4).

The values obtained for friability and dust generation, although within the range previously tested by PETROSIX, were closer to the end of the range. This supports the conclusions drawn from the visual observation of the particles after retorting.

From the standpoint of the PETROSIX Process, both shales exhibit properties within the range of acceptable feeds. The behavior during retorting in the Fischer retort for the Albert Mines Zone sample, as well as the lower mechanical strength of the retorted shale, indicate that some attention should be paid to pressure drop, dust carryover and fines generation. Those aspects will be more significant in the bottom of the retorting bed, the cooling bed and the retorted shale discharge mechanism.

The TGA analyses show slightly different behavior for the two shales (figures 2.5 and 2.6). Both show the devolatilization of the organic matter in the temperatures between 370-520 C, with a peak in the range of 470-480 C.

For the Albert Mines Zone sample, the completion of organic matter liberation is followed by a second peak, significantly lower, which may be due to pyrite reduction. A third peak, that extends from 560 to 770 C, corresponds to carbonate decomposition.

For the Dolomite Marlstone Zone sample, the same three peaks appear. However, as there is no return to the base line, the analysis suggests that the three steps are occurring partially superimposed. More specifically, the end of the organic matter devolatilization immediately is followed by pyrite reduction and carbonate decomposition.

The beginning of the carbonate decomposition occurs within the temperature interval corresponding to the kerogen decomposition for the sample of Dolomite Marlstone. This is better evidenced in the chromatographic analysis of the gases from the Fischer assay, which shows a significant production of CO_2, even for a temperature below 500 C.

The Fischer assay oils obtained for both samples are practically identical in regard to composition. The Albert Mines Zone sample oil had a slightly lower density and a higher pour point than the oil from the Dolomite Marlstone Zone material, as can be seen in table 2.6.

2.6 TABLES AND FIGURES

TABLE 2.1

NEW BRUNSWICK RAW SHALE

PHYSICAL PROPERTIES

		SAMPLES	
		ALBERT MINES ZONE	DOLOMITE MARLSTONE ZONE
Screen analysis, wt % (1)			
- 3/4" + 1/2"		48.0	39.9
- 1/2" + 1/4"		28.7	28.9
- 1/4"		23.3	31.2
Apparent relative density	(2)	1.976	2.318
Bulk density, kg/m3	(2)	886	1110
Average Sphericity	(2)	0.687	0.732
Permeability index, Nm3/min	(2)	47.4	52.3
Grain size reduction in the modified Los Angeles test, wt %			
- 3/4" + 1/2"		30.3	26.9
- 1/2" + 1/4"		59.0	60.7
Adhered fines index, wt %	(2)	0.43	0.18

NOTES:

(1) After crushing for the retort feed preparation

(2) Properties determined on the Pilot plant charges

TABLE 2.2

NEW BRUNSWICK RAW SHALE

CHEMICAL PROPERTIES

	SAMPLES	
	ALBERT MINES ZONE	DOLOMITE MARLSTONE ZONE
Moisture, wt % (1)	6.71	5.39
Moisture, wt % (2)	2.77	1.06
Modified Fischer Assay, wt %		
- material from + 1/4 to + 3/4" (2)		
. oil	11.96	6.10
. water	1.38	0.93
. spent shale	84.55	91.09
. gas + losses	2.11	1.88
- fines below 1/4" (3)		
. oil	10.91	5.70
. water	1.52	0.95
. spent shale	85.56	91.78
. gas + losses	2.01	1.57
Gross heating value, kcal/kg	1651	899
Loss by burning at 950 C, wt %	28.46	21.11
Total Carbon, wt %	16.58	10.75
Mineral carbon, wt %	2.56	2.98
Total hydrogen, wt %	2.19	1.37
Total sulfur, wt %	1.04	.90
Pyritic sulfur, wt %	1.00	.74
Sulfate sulfur, wt %	0.02	.03
Weight loss in Fischer assay, wt % (2)		
. at 300 C	1.15	1.18
. at 350 C	2.10	1.64
. at 400 C	7.32	4.59
. at 450 C	13.14	8.09
. at 500 C	15.51	8.25

NOTES: (1) material as received
(2) properties determined on the retort feed
(3) fines generated during retort charges preparation

TABLE 2.3

NEW BRUNSWICK SPENT SHALE

FROM MODIFIED FISCHER ASSAY

PHYSICAL PROPERTIES

	SAMPLES	
	ALBERT MINES ZONE	DOLOMITE MARLSTONE ZONE
Particle Thermal degradation		
. at 300 C	NONE	NONE
. at 400 C	SMALL	NONE
. at 500 C	MODERATE	SMALL
Modified tumbler test		
. friability, wt %	74.0	76.5
. dust index, wt %	26.1	27.0

TABLE 2.4

NEW BRUNSWICK SHALE ASH

	SAMPLES	
	ALBERT MINES ZONE	DOLOMITE MARLSTONE ZONE
Loss by burning at 950 C, wt %	28.46	21.11
Ash content, wt %	71.54	78.89
Ash composition (1), wt %		
. SiO_2	55.69	54.84
. Al_2O_3	15.01	17.89
. Fe_2O_3	5.69	6.78
. CaO	13.84	8.92
. MgO	3.71	6.08
. P_2O_5	0.61	0.54
. MnO	0.09	0.13
. Others (K_2O, Na_2O, etc)	5.36	4.82

NOTES:

(1) Elemental oxides are reported on the basis of the 950 C ash

TABLE 2.5

NEW BRUNSWICK SHALE GAS

FROM MODIFIED FISCHER ASSAY

	SAMPLES	
	ALBERT MINES ZONE	DOLOMITE MARLSTONE ZONE
Chromatographic analysis, vol %		
. H_2	42.6	39.3
. H_2S	4.3	9.7
. N_2	0.0	0.0
. CO	2.2	1.9
. CO_2	3.8	14.1
. Methane	17.9	15.4
. Ethane	8.6	5.5
. Ethylene	3.9	1.9
. Propane	4.5	3.1
. Propylene	4.6	2.8
. Butanes	2.0	1.5
. Butenes	3.0	2.5
. Pentanes and higher	2.6	2.3
Molecular weight, g/gmol	19.9	22.1
Gross heating value, Cal/g	11163	8052
Net heating value, Cal/g	10186	7330

TABLE 2.6

NEW BRUNSWICK SHALE OIL

FROM MODIFIED FISCHER ASSAY

	SAMPLES	
	ALBERT MINES ZONE	DOLOMITE MARLSTONE ZONE
Density 20/4 C	.876	.885
Pour Point, C	10	5
Elemental Composition, wt %		
. Carbon	85.6	85.5
. Hydrogen	12.2	12.3
. Sulfur	.7	.5
. Nitrogen	1.0	1.1
Gross heating value, Cal/g	10501	10455

SAMPLE TREATMENT AND ASSAY DIAGRAM
FOR NEW BRUNSWICK SHALE – ALBERT MINES ZONE SAMPLE

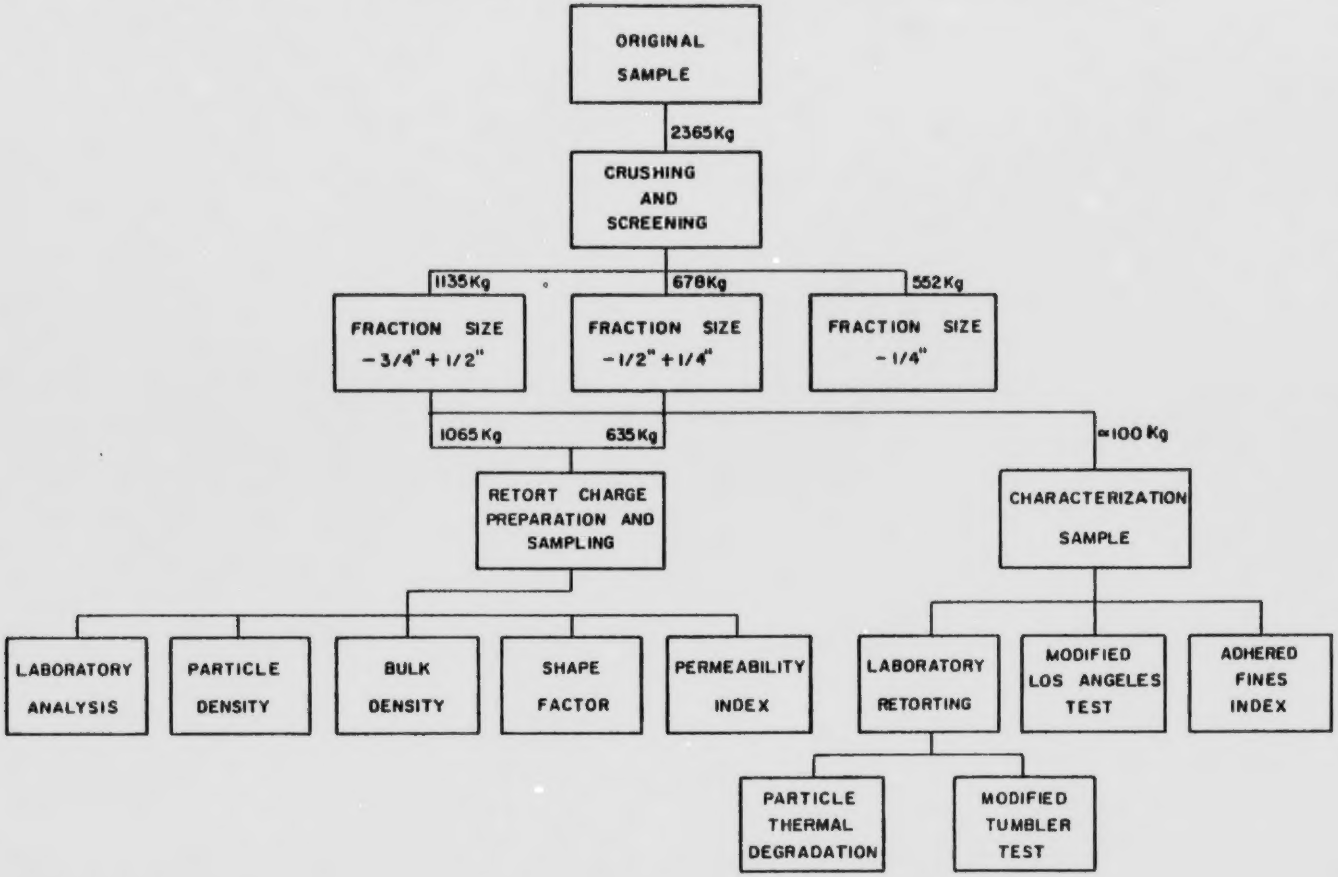


FIGURE 2.1

SAMPLE TREATMENT AND ASSAY DIAGRAM
FOR NEW BRUNSWICK SHALE – DOLOMITE MARLSTONE ZONE SAMPLE

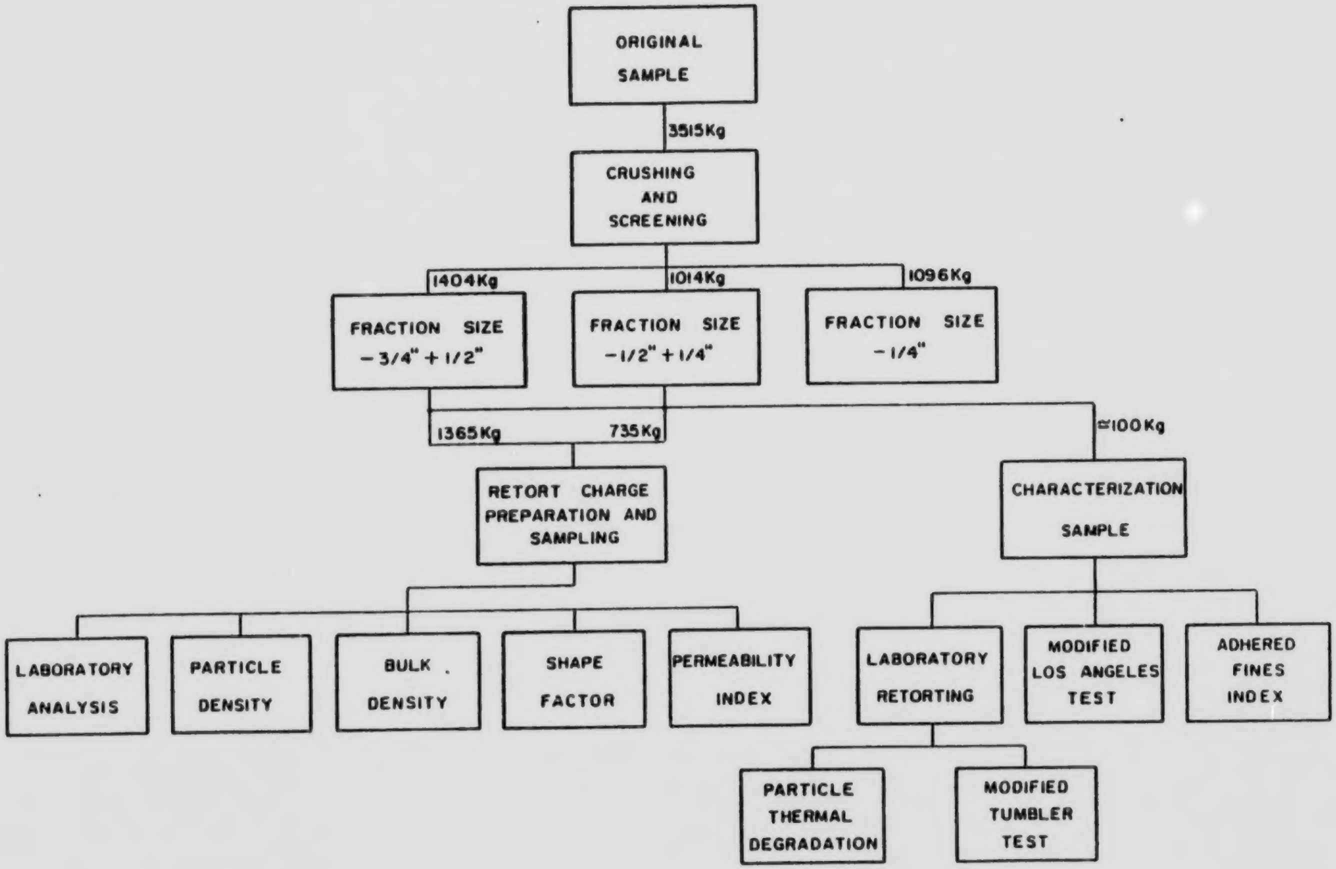
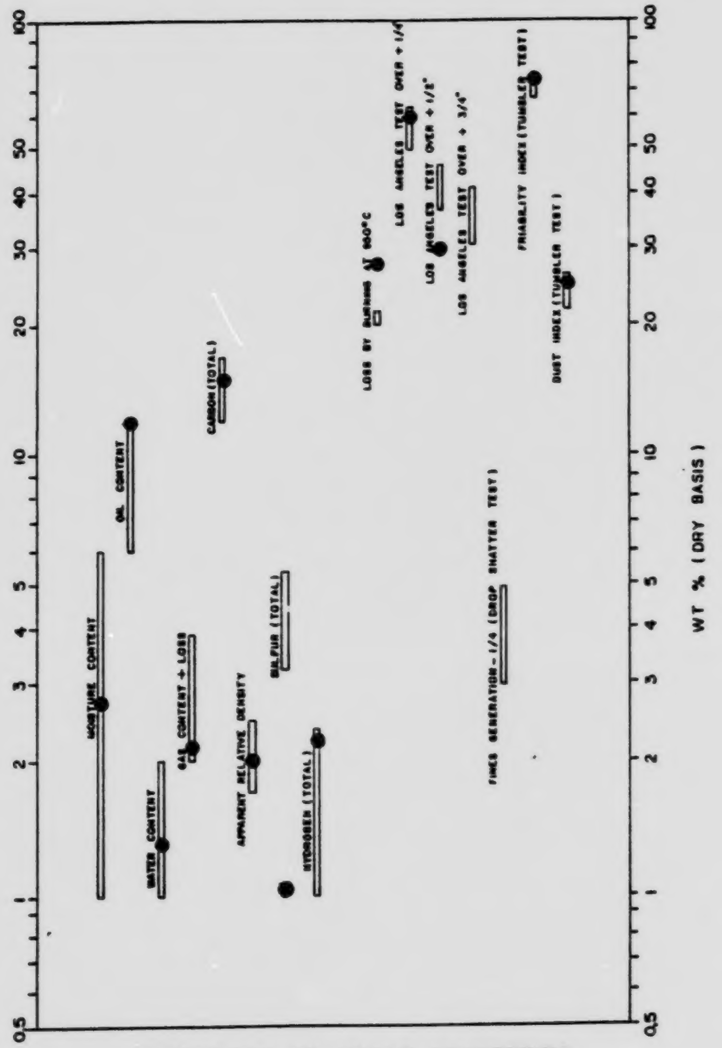


FIGURE 2.2

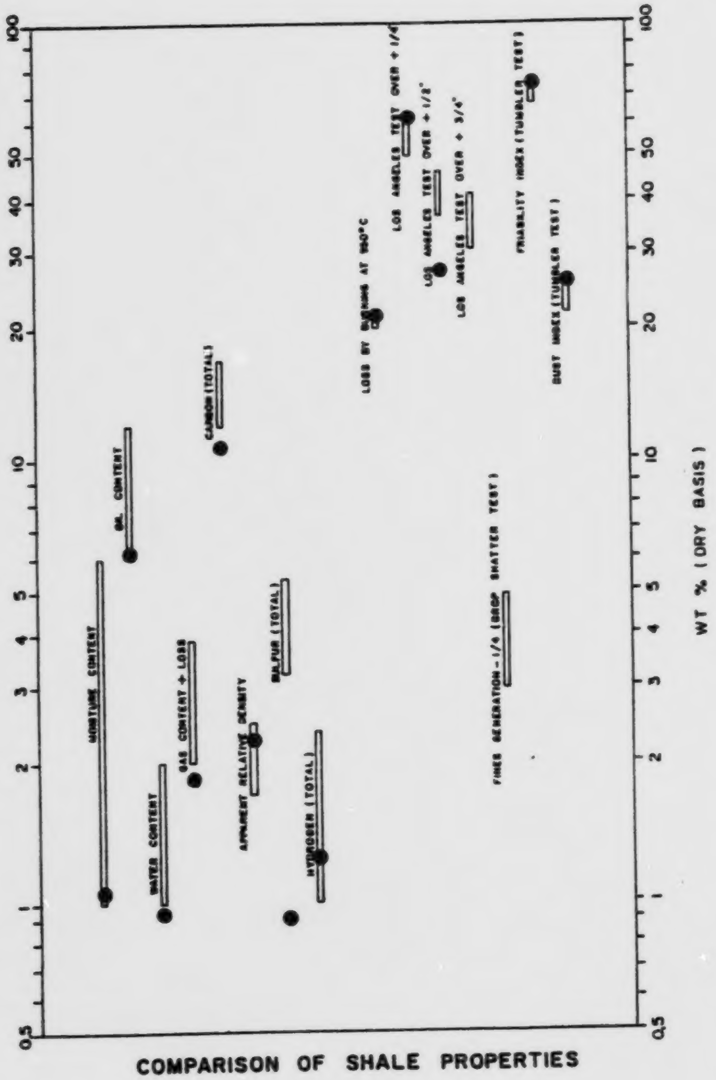


COMPARISON OF SHALE PROPERTIES

▯ IRATI OIL SHALE (REFERENCE RANGE)

● NEW BRUNSWICK OIL SHALE - ALBERT MINES ZONE SAMPLE

FIGURE 2.3

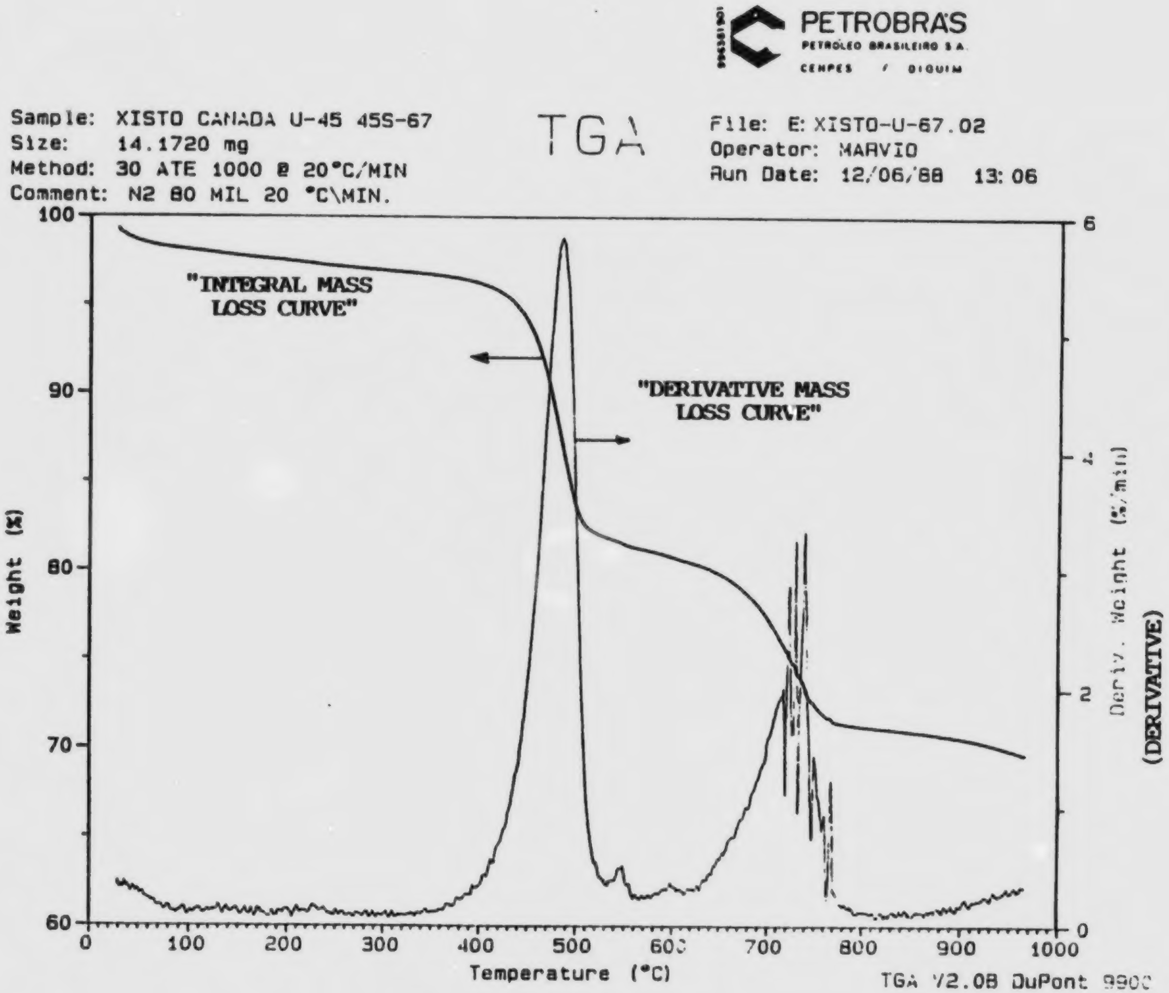


COMPARISON OF SHALE PROPERTIES

▯ IRATI OIL SHALE (REFERENCE RANGE)

● NEW BRUNSWICK OIL SHALE - DOLOMITE MARLSTONE ZONE SAMPLE

FIGURE 2.4

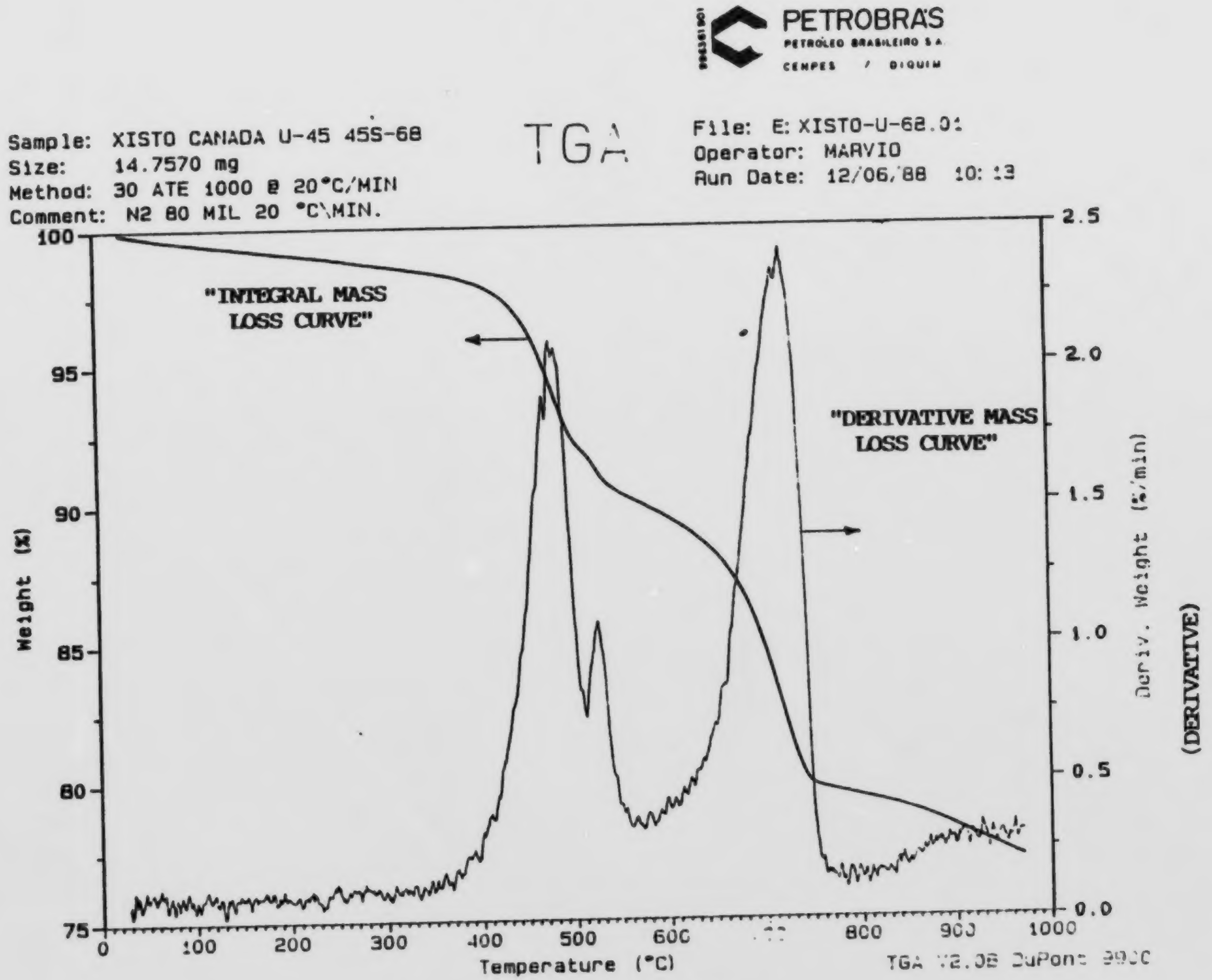


Sample: XISTO CANADA U-45 45S-67
Size: 14.1720 mg
Method: 30 ATE 1000 @ 20°C/MIN
Comment: N2 80 MIL 20 °C\MIN.

File: E: XISTO-U-67.02
Operator: MARVIO
Run Date: 12/06/88 13: 06

ALBERT MINES ZONE SAMPLE

FIGURE 2.5



DOLOMITE MARLSTONE ZONE SAMPLE

FIGURE 2.6

NEW BRUNSWICK OIL SHALE

TECHNOLOGICAL CHARACTERIZATION

AND

PETROSIX PILOT PLANT RETORTING TESTS

TECHNICAL REPORT

CHAPTER 3 - PILOT PLANT TESTS

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CHAPTER 3 - PILOT PLANT TESTS

3.1 PURPOSE

The objective of the retorting tests in the PETROSIX Pilot Plant was to verify how New Brunswick oil shale as represented by the Albert Mines Zone and Dolomite Marlstone Zone samples behaves when pyrolyzed in the PETROSIX Process and to make a preliminary evaluation of the process for this shale.

Specifically, the following objectives were pursued:

. Investigate the oil shale behavior inside the pilot PETROSIX retort.

. Determine suitable conditions to retort New Brunswick oil shale.

. Measure of the more important process variables.

. Determine of the products properties.

Investigation of the behavior of the shale during retorting is made by observation of such phenomena as oil mist formation, entrainment of oil mist and dust by the recycle gas, particle size degradation and formation of fines, and changes occurring in the shale particles.

The determination of adequate retorting conditions is performed by changing variables according to a previously established schedule. The following variables are changed:

. Retorting rate

. Pyrolysis temperature

The essential variables measured and recorded in the tests are:

. Retorting rate

. Recycle gas flows and temperatures

. Pyrolysis temperature

. Pyrolysis bed pressure drop

. Oil, water and gas yields.

Several other variables are recorded for operational purposes and to interpret and evaluate the tests.

The products obtained from the tests are analyzed in the laboratory for properties which are important to determine the material and energy balances.

3.2 PILOT PLANT DESCRIPTION

3.2.1 General

The PETROSIX Pilot Plant was designed to simulate the operation of the larger Semi-Works Plant (UPI). It contains all the same component equipment that exists in the large size plant, as follows (see attached process flow diagram, figure 3-1):

- PETROSIX Retort
- Cyclone
- Eletrostatic Precipitator
- Recycle Gas Compressor
- Fired Gas Heater
- Light Oil and Water Condenser.

The pilot plant was sized to process up to 100 kg/h of Irati Oil Shale with the size range of 1/4" to 3/4".

3.2.2 Retort Characteristics

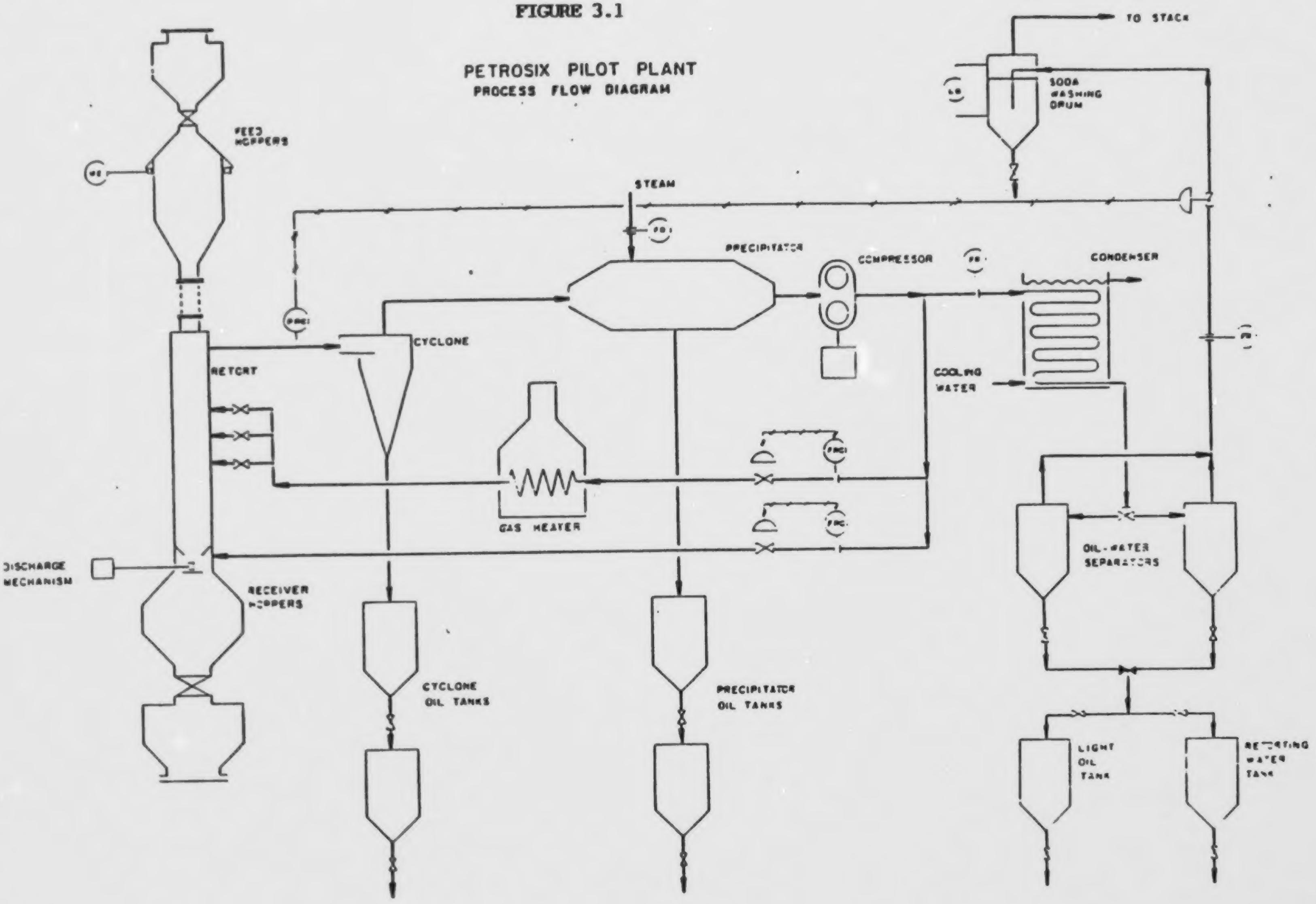
The retort has an internal diameter of 20.3 cm and is 5.3 meters high. It is insulated and heat traced with electrical resistances to minimize heat losses.

The retort is fed from two feed hoppers that have a capacity of 2 metric tons, sufficient to provide material for about 16 hours of operation at a retorting rate of 2700 kg/hm2. The two hoppers are connected by a valve that permits feeding while operating the plant in a pre-test condition. The hoppers have load cells that indicate the amount of shale within during the test and thus provide control of the retorting rate.

The retort is equipped with two receiver hoppers. The hoppers are also separated by a valve that enables discharging and sampling the retorted shale from more than one test.

FIGURE 3.1

PETROSIX PILOT PLANT
PROCESS FLOW DIAGRAM



The retort also has hot recycle gas injectors at three levels and one cold recycle gas injector in the bottom.

A discharge mechanism at the bottom of the retort regulates and controls the shale throughput.

The retort vessel has eight thermocoples for temperature and seven taps for pressure. Their position and identification are shown in the attached diagram figure 3.2.

3.2.3 Solids Flow

The feed shale from the feed hoppers descends through the pyrolysis vessel by gravity countercurrent to a hot gas stream. After being heated up and retorted in the pyrolysis bed, the shale descends where it is cooled by a cold gas stream ascending from the retort bottom. The shale is withdrawn through the discharge mechanism into the receiver hoppers. At the end of each test the retorted shale is removed from the receiver hopper.

3.2.4 Gases Flow

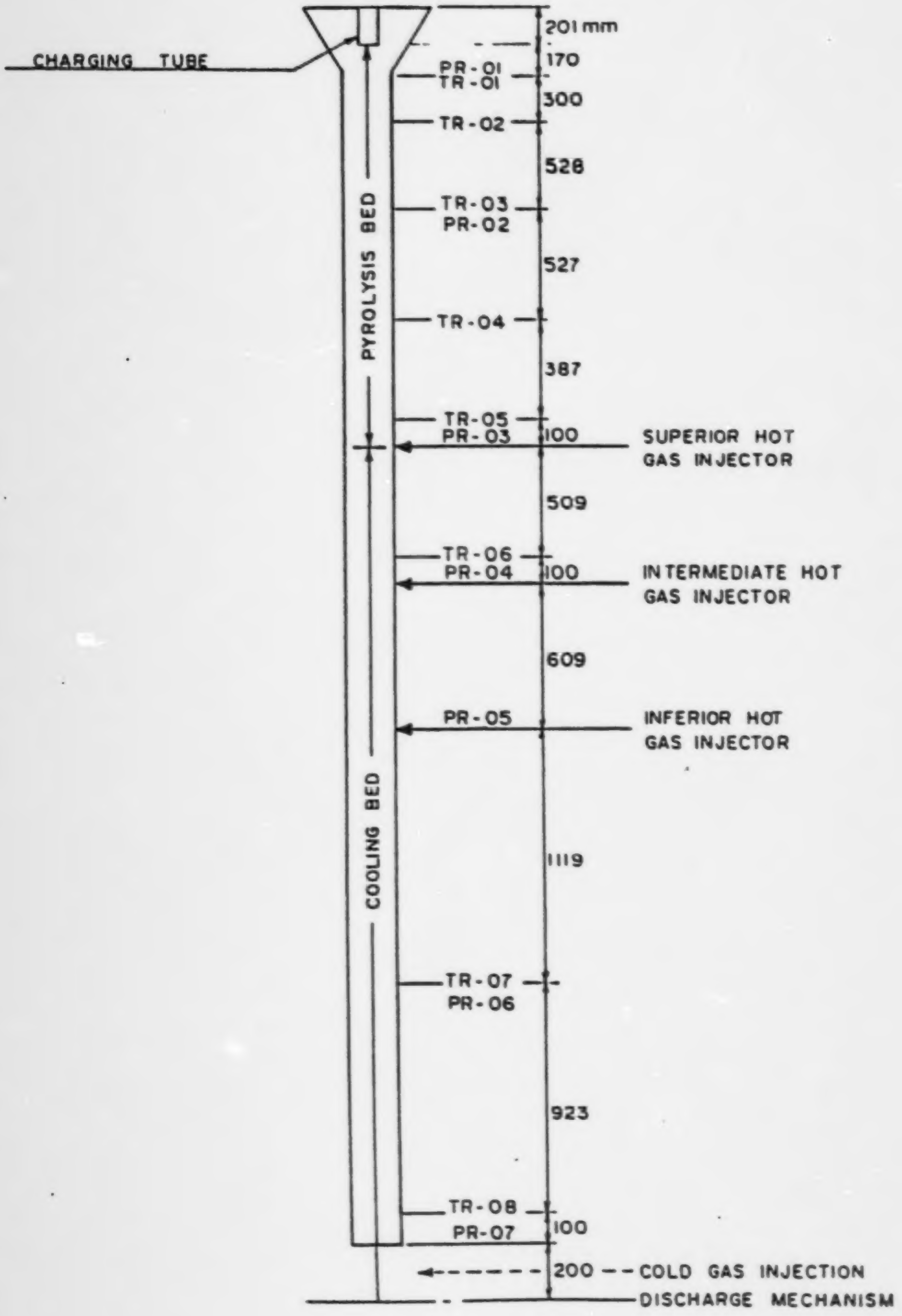
The hot recycle gas is injected into the middle section of the pyrolysis vessel. The cold recycle is injected into the bottom of the retort and ascends through the retorted shale, receiving heat thereby becoming hotter. At the middle of the pyrolysis vessel the two recycles streams are mixed, balancing temperatures at the required level to pyrolyze the shale. The hot gas stream ascends and carries the pyrolysis products and transfers the heat to the shale, thereby becoming colder. The heavy oil is condensed, forming an oil mist which is carried by the gas stream and recovered in the cyclone and precipitator. The gas stream is compressed and split in to three streams. The first one is heated in the furnace and recycled back to the retort as the hot recycle stream. The second one is injected in the bottom of the retort as the cold recycle stream, and the third stream flows to the condenser to recover the light oil and the retort water. The non-condensable components constitute the raw retorting gas which is measured through an orifice plate and proceeds to the caustic soda washing drum and finally to the stack.

3.2.5 Liquids Flow

The oil recovered in the cyclone is collected in the cyclone oil tanks. At the end of the test all the cyclone oil is sent to the laboratory for measuring, sampling and analyses.

FIGURE 3.2

TERMOCOUPLES AND PRESSURE TAPS IN THE PETROSIX PILOT RETORT



The oil recovered in the precipitator is collected in tanks and, at the end of the test, sent to the laboratory to be measured, sampled and analyzed.

The light oil and retorting water are condensed in a coil heat exchanger and collected in drums where they are separated by gravity. The water is drained to the retort water tank and the light oil is separate to the light oil tank. At the end of the test, all the light oil is sent to the laboratory to be measured, sampled and analyzed. The retort water is measured and sampled at the tank.

3.3 TESTING PROGRAM AND PROCESS VARIABLES

The Pilot Plant testing program on New Brunswick oil shale consisted of two sets of tests, one for each sample. The number of tests was limited by the amount of shale available.

As the thermogravimetric analysis didn't show any abnormal characteristics for both samples in the temperature range corresponding to the organic matter release, all tests were run at a pyrolysis temperature of 500 C.

Initially plans were set for the two samples to be run at two retorting rate levels, respectively at 2000 and 2700 kg/hm2.

However, as the retort charge permeabilities were relatively low, and we were unable to make a pre-test between the first and second test due the amount of shale. The average retorting rate for the second test was lower than planned. Also, the particle thermal degradation shown by the Albert Mines Zone sample contributed to a reduced retorting rate for that shale.

3.4 OPERATIONAL PROCEDURES

3.4.1 Feed Preparation and Sampling

The retort charges for the Pilot Plant tests were prepared in the Solids Laboratory (LABTRAT) according to the diagrams shown in figures 2.1 and 2.2 in chapter two. Sampling was carried out during the transfer of material from the homogenized pile to the drums used to transport the charge to the retorting plant.

3.4.2 Feeding and Purging

At the retorting plant shale is transported to the top of the retort and dumped into the feed hoppers. The feed hoppers are closed and the system is purged with inert gas for about 3 hours.

3.4.3 Start-up

After purging the system, the eletrostatic precipitator, recycle gas compressor and fired gas heater are turned on. The recycle gas flow and hot recycle temperature are adjusted to the desired levels. As the temperature inside the retort rises, the discharge mechanism is turned on and the shale starts to flow through the retort and into the receiver hoppers.

By adjusting the operating variables to appropriate values, the scheduled test conditions are reached in about 6 hours. This period of time is not enough to reach a steady state regime for the cooling bed, due to the low recycle cold gas flow used in the pilot plant. But since the intent is to perform the test using small shale charges, it is assumed that this will cause no problem in the retort energy balance.

3.4.4 Test Performing

After the scheduled conditions are attained the first test is started. The valves between the upper and lower oil tanks are shut and the indicated values of the load cell and product gas totalizer are recorded.

The raw shale flow rate is measured by reading the load cell indicator as frequently as needed. It is controlled by changing the speed of the discharge mechanism.

Flow of recycle gas is adjusted by control valves at the hot and cold recycle gas lines.

The process temperatures (pyrolysis, retorted shale, retort off-gas) are maintained at the desired levels by controlling the hot and cold recycles flows and the fuel to the gas heater.

Process variables are changed once during each run to provide different test conditions.The time required for the change and to re-establish stable conditions depends on the variables changed, but in general, a time period of two hours is sufficient.

The test duration depends upon the retorting rate and the available raw shale in the feed hopper.

The retort products are measured and sampled as follows:

- The retorted shale is sampled during its withdrawal from the receiver hopper. The weight of retorted shale is determined by balance calculations.
- The heavy oil from the cyclone and precipitator and the light oil from the condenser are collected in gaging tanks, weighed and sent to the laboratory for sampling and analyzing. The handling procedures for the oil are described in section 5.3 of the appendix.

- The retorting water is sampled and then transferred to the gaging tank to be measured.

- The product gas flow is measured by an integral orifice with register connected to a digital totalizer. The product gas is sampled two times during each test. The sample is collected in a stainless steel bomb using a small compressor to increase the gas pressure from 5 to 35 psig.

3.5 RESULTS

The main results of the tests are summarized on the following data sheets (Tables 3.5.1, 3.5.2, 3.5.3, 3.5.4 and 3.5.5). The complete data comprising the computer data calculations, operating data sheets and instrument charts are provided in the appendix.

TABLE 3.5.1

NEW BRUNSWICK OIL SHALE

PETROSIX PILOT PLANT TESTS

MAIN VARIABLES

	DOLOMITE MARLSTONE ZONE SAMPLE		ALBERT MINES ZONE SAMPLE		
TEST NUMBER	212.1	212.2	213.1	213.2	213.3
Retorting rate, kg/hm2	2150	2587	1916	2076	2194
Pyrolysis temperature, C	495	504	498	501	505
Retort off gas temperature, C	192	197	202	204	205
Gas-to-shale ratio	.85	.80	.99	1.04	.94
Pressure drop (pyrolysis bed) cmHg	3.4	4.5	4.0	4.4	5.2
Yields on Fischer assay, wt%					
. oil	94.6	98.2	100.0	102.8	101.3
. gas	125.9	127.6	92.2	87.4	89.0
. oil + gas	102.0	105.0	98.8	100.5	99.4
Balances, out/in recovery, %					
. material balance	100.2	100.3	92.8	99.9	99.0
. water balance	93.3	100.9	61.6	96.0	89.8
. carbon balance	101.7	101.9	100.3	101.6	102.4
. hydrogen balance	103.1	103.7	100.5	102.8	100.9
. sulfur balance	85.2	87.4	74.9	99.1	68.1

TABLE 3.5.2

NEW BRUNSWICK OIL SHALE

PETROSIX PILOT PLANT TESTS

SHALE PROPERTIES

	DOLOMITE MARLSTONE ZONE SAMPLE		ALBERT MINES ZONE SAMPLE		
TEST NUMBER	212.1	212.2	213.1	213.2	213.3
FEED SHALE PROPERTIES					
. moisture, wt%	1.06	1.06	2.77	2.77	2.77
. Fischer assay, wt%					
. oil	6.10	6.10	11.96	11.96	11.96
. water	.93	.93	1.38	1.38	1.38
. residue	91.09	91.09	84.55	84.55	84.55
. gas + loss	1.88	1.88	2.11	2.11	2.11
. total carbon, wt%	10.75	10.75	16.58	16.58	16.58
. mineral carbon, wt%	2.98	2.98	2.56	2.56	2.56
. total hydrogen, wt%	1.37	1.37	2.19	2.19	2.19
. total sulfur, wt%	.90	.90	1.04	1.04	1.04
. pyritic sulfur, wt%	.74	.74	1.00	1.00	1.00
. gross heating value, cal/g	899	899	1651	1651	1651
RETORTED SHALE PROPERTIES					
. Fischer assay, wt%					
. oil	.00	.00	.00	.12	.19
. water	.45	.39	.58	.45	.56
. residue	99.49	99.55	99.40	99.41	99.24
. gas + loss	.06	.06	.02	.02	.01
. total carbon, wt%	5.57	5.43	6.42	6.41	6.64
. mineral carbon, wt%	2.76	2.35	3.09	3.12	3.04
. total hydrogen, wt%	.53	.49	.46	.48	.48
. total sulfur, wt%	.70	.70	.70	.90	.50
. pyritic sulfur, wt%	.03	.03	.26	.33	.31
. gross heating value, cal/g	269	292	311	312	346

TABLE 3.5.3

NEW BRUNSWICK OIL SHALE
PETROSIX PILOT PLANT TESTS
OIL PROPERTIES

	DOLOMITE MARLSTONE ZONE SAMPLE		ALBERT MINES ZONE SAMPLE		
TEST NUMBER	212.1	212.2	213.1	213.2	213.3
CLEAN CYCLONE OIL					
. density, 20/4 C	.979	.974	.939	.942	.941
. viscosity at 54 C (cSt)	321.6	205.6	56.2	82.6	67.6
. viscosity at 99 C (cSt)	28.3	21.8	11.0	14.1	11.9
CLEAN PRECIPITATOR OIL					
. density, 20/4 C	.949	.945	.925	.925	.921
. viscosity at 38 C, cSt	124.7	93.2	49.6	52.0	34.0
. viscosity at 54 C, cSt	49.4	34.5	23.5	24.3	17.8
CLEAN LIGHT OIL					
. density, 20/4 C	.810	.813	.793	.784	.792
. distillation, C					
. PIE	80	82	75	65	71
. T10	130	131	112	103	107
. T30	159	162	145	137	142
. T50	188	192	175	169	174
. T70	220	226	206	204	209
. T90	266	276	253	251	256
CLEAN COMPOSITE OIL					
. density, 20/4 C	.931	.931	.910	.909	.911
. viscosity at 38 C, cSt	41.85	41.15	26.03	24.70	25.10
. viscosity at 54 C, cSt	22.45	19.56	14.46	13.42	12.43
. ramsbottom carbon, wt%	3.35	3.25	1.85	2.06	2.13
. total carbon, wt%	85.16	85.10	84.80	84.78	85.05
. total hydrogen, wt%	11.78	11.84	12.08	12.16	11.90
. sulfur, wt%	.93	.62	.72	.82	.81
. nitrogen, wt%	1.19	1.12	1.04	1.00	1.14
. gross heating value, cal/g	10162	10250	10335	10399	10393
. ash, wt%	.34	.34	.07	0.02	.08
. flash point, C	32	48	31	34	28
. pour point, C	0	0	17	17	12
. distillation, C					
. PIE	48	73	64	69	63
. T10	204	203	199	195	202
. T30	348	343	342	343	345
. T50	424	419	420	420	428
. T70	492	483	488	491	493
. T80	518	508	510	517	522

TABLE 3.5.4

NEW BRUNSWICK OIL SHALE

PETROSIX PILOT PLANT TESTS

RETORT WATER AND GAS PROPERTIES

	DOLOMITE MARLSTONE ZONE SAMPLE		ALBERT MINES ZONE SAMPLE		
TEST NUMBER	212.1	212.2	213.1	213.2	213.3
RETORT WATER PROPERTIES					
. sulfur, g/l	1.92	2.21	2.01	7.01	7.90
. ammoniacal nitrogen, g/l	5.21	5.98	4.79	6.87	8.77
. oil, g/l	.16	.14	.23	.23	0.09
. phenols, ppm	125	175	169	144	165
. pH 25 C	8.6	8.7	8.7	9.3	9.2
AVERAGE GAS PROPERTIES					
. composition, vol %					
.. H_2O	2.83	3.45	4.27	5.35	3.22
.. H_2S	2.37	2.27	1.84	2.81	3.07
.. O_2	.25	.44	.25	.27	.19
.. N_2	9.52	6.98	10.27	12.79	10.50
.. CO	.60	.75	1.54	1.32	1.37
.. CO_2	29.92	28.65	8.71	9.07	8.76
.. H_2	32.74	35.02	32.59	31.09	32.25
.. methane	11.31	11.36	17.62	16.58	17.70
.. ethane	3.14	3.11	6.50	5.94	6.05
.. ethylene	1.09	1.17	2.29	2.09	2.26
.. propane	1.53	1.48	3.09	2.63	2.79
.. propylene	1.45	1.50	3.29	2.72	3.01
.. isobutane	.17	.17	.24	.23	.24
.. N-butane	.62	.62	1.49	1.22	1.37
.. isobutene + butene-1	.81	.87	1.75	1.39	1.61
.. butene 2T	.22	.25	.48	.40	.49
.. butene 2C	.29	.33	.55	.45	.55
.. isopentane	.15	.13	.22	.20	.22
.. C5+	.99	1.45	3.01	3.45	4.35
. molecular weight, g/gmol	24.46	23.84	22.43	22.75	23.16
. gross heating value, cal/g	4273	4652	8278	7640	8313

TABLE 3.5.5

NEW BRUNSWICK OIL SHALE

PETROSIX PILOT PLANT TESTS

RETORT ENERGY BALANCES

	DOLOMITE MARLSTONE ZONE SAMPLE		ALBERT MINES ZONE SAMPLE		
TEST NUMBER	212.1	212.2	213.1	213.2	213.3
ENERGY BALANCE (RETORT)					
- INPUT, Kcal/h					
. dry raw shale	423.8	510.1	371.2	402.3	425.1
. moisture	18.4	22.1	42.8	46.4	49.0
. hot recycle	12280.6	14300.1	12545.6	14769.1	14034.9
. cold recycle	190.4	234.4	199.0	205.0	218.1
. total	12913.2	15066.7	13158.6	15422.8	14727.1
- OUTPUT, Kcal/h					
. retorted shale	5134.8	8266.1	3876.7	4188.0	6308.0
. hot recycle	4316.0	5020.2	4561.5	5372.4	5084.6
. cold recycle	321.0	342.4	353.6	351.1	363.7
. product gas	124.0	163.3	121.8	123.8	135.5
. entrained solids	12.9	26.9	9.0	9.2	31.0
. cyclone oil	37.5	88.7	167.1	199.6	338.0
. precipitator oil	288.7	320.5	471.3	504.9	395.7
. vaporized light oil	91.3	128.9	154.5	197.1	212.0
. retorting water	740.8	929.7	1540.7	1718.8	1773.9
. carbonates decomposition	902.0	1956.0	71.8	74.9	76.4
. pyrites decomposition	18.0	21.7	11.1	17.4	19.7
. endothermic reactions	157.9	190.0	138.3	149.8	158.3
. heat losses (by difference)	768.3	-2387.7	1681.2	2515.8	- 169.6
. total	12913.2	15066.7	13158.6	15422.8	14727.1
Heat demand, Kcal/kg (1)	101.8	138.4	99.4	100.5	126.8

(1) Heat demand = (hot and cold recycle gas heat input - hot and cold recycle gas heat output - heat losses) /wet raw shale throughput

3.6 DISCUSSION OF RESULTS

3.6.1 Tests and Pilot Plant Performance

The tests were executed according to the conditions discussed in section 3.3.

The duration of each test was set at 8 hours for the lower retorting rate of Dolomite Marlstone Zone due to its lower oil content, and at 6 hours for the other tests.

Two test were run for the Dolomite Marlstone Zone sample and three tests for the Albert Mines Zone sample. The tests were numbered: 212.1, 212.2, 213.1, 213.2 and 213.3.

For the Albert Mines Zone sample run, after the conclusion of test number 213.1 plugging, in the retort-cyclone duct by solids entrained from the pyrolysis bed, was observed. The Pilot Plant was stopped, the equipment were cleaned and the plant was restarted to run test numbers 213.2 and 213.3. This obstruction of the gas outlet was attributed to fines generated during retort feeding and the fines from the pyrolysis bed. We must point out that due the geometrical configuration of the gas duct, obstructions are frequently encountered for Irati oil shale processing after several hours of plant operation.

The Pilot Plant performance for the two New Brunswick oil shale samples was quite different. Althought, both samples exhibited almost the same values for retorted shale mechanical strenght, the differences observed for the particle thermal degradation became rather significant. This became very clear from the amount of fine particles detected in the retorted shale, as shown by the granulometric analysis made on the retorted shale samples collected for tests number 212.2 and 213.1 (see table 3.6.4). This influence affected operational variables such as retorting rate, pressure drop and solids entrainment.

Althought the conditions programmed for the Albert Mines Zone sample were not attained because of the preceding, the plant operation was smooth as can be noted in the instrumment charts presented in the appendix for tests (212.2 and 213.1).

3.6.2 Retorting Rate

Retorting rate in the Pilot Plant is a variable controlled by the raw shale flow rate. As noted in section 3.3, the average retorting rate deviated from the programmed values particulary for the Albert Mines Zone sample (see table 3.5.1).

3.6.3 Pyrolysis Temperature

The pyrolysis temperature in the Pilot Plant is controlled by the solids flow and the temperature of the hot recycle gas. The cold gas recycle has little effect, for its rate is usually low for this plant.

The flow rate and the temperature of the hot recycle gas can not be altered independently. They also determine the temperature of the gas outlet, which has to be maintained within certain limits. Therefore, some adjustments were necessary during the tests, which caused variations in the pyrolysis temperature. These variations, however, were kept within normal limits, and the maximum deviation between the actual average and the programmed pyrolysis temperature was 5 C.

The pyrolysis temperature level of 500 C for both New Brunswick oil shale samples has been shown to be satisfactory as seen by the oil and gas yields attained, as well as the qualities of the products obtained (see tables 3.5.1 to 3.5.4).

3.6.4 Outlet Gas Temperature

The outlet gas temperature in the PETROSIX process is important in the temperature profile. The process accepts for this variable, a relatively wide range of values which depend on some properties of the raw shale such as moisture and oil content..

For the New Brunswick oil shale tests, temperature levels of 190 C and 200 C were selected respectivelly for the Dolomite Marlstone Zone and the Albert Mines Zone samples. These are customary values for the Pilot Plant and were fixed taking into consideration the oil content of the samples.

3.6.5 Gas-to-Shale Ratio (G/X)

The average values of G/X was about 0.82 for the Dolomite Marlstone Zone sample and about 0.99 for the Albert Mines Zone sample. The difference can be attributed to a lower moisture content for the Dolomite sample and probably to differences in heats of reaction and specific heat values between the two samples.

The G/X ratios are still within the range obtained for Irati oil shale processed in this Pilot Plant.

3.6.6 Pressure Drop in the Pyrolysis Bed

The pressure drop through the pyrolysis bed for the Albert Mines Zone sample was about 23% higher than that observed for the Dolomite Marlstone Zone sample, at the same retorting rate. This difference is a consequence of the higher G/X ratio value, the lower permeability index and also the greater thermal degradation of the Albert Mines Zone Shale.

Compared to values observed for Irati oil shale processing at the same conditions, the pressure drop for Dolomite Marlstone Zone sample were similar. Therefore, the pressure drop for the Albert Mines Zone sample is approximately 23 % higher than that observed for Irati oil shale processing.

The limited quantity of the Albert Mines Zone sample precluded determination of the optimum feed charge permeability. Considering the particle size reduction during retorting, the effect of pressure drop over retorting rate must be better documented in order to assess the retorting rate for this shale in a larger scale retort.

3.6.7 Oil Yield

The oil yields were calculated based on the Fischer assay data obtained for both samples, chapter 2.

The oil yield obtained for the Dolomite Marlstone Zone and Albert Mines Zone samples were respectively in the ranges of 95 to 98 and 100 to 103 %. These values were just within the range observed for Irati oil shale processing.

The lower values for Dolomite Marlstone Zone sample yields can be partially atributed to a loss of oil, that remained on the inner walls of the equipment. These losses are closely related to the size and characteristics of the Pilot Plant, as also observed in tests with Irati oil shale. However, its influence is lower, because the amount of oil produced is comparatively greater. This aspect was also shown by the oil yields obtained for the Albert Mines Zone sample.

3.6.8 Gas Yield

The gas yields compared to Fischer assay obtained for the New Brunswick oil shale had two distinct ranges of values. They varied from 126 to 128 % for the Dolomite Marlstone Zone sample and from 87 to 92 %, for the Albert Mines Zone sample.

The higher gas yields for the Dolomite Marlstone Zone sample are impart supported by the chromatographic analysis made on gases produced from the Fischer assay, and also from the mineral carbon content found in the retorted shale. The sample exhibits significative carbonate decomposition, even in the retorting temperature range. Steam present in the Pilot Plant gas recycle, man promote generation of carbon-oxide gases.

The gas yields for the Albert Mines Zone sample were lower than those normally obtained for Irati oil shale.

3.6.9 Material and Water Balances

In the Pilot Plant it is not possible to weigh the retorted shale during the test. Therefore it is calculated for the material balance. The retorted shale is calculated from the loss on ignition data for the raw and retorted shale samples for each test.

The water balances are determined from water flow measurements. Water in the retorted shale is calculated from the retorted shale flow, the mass balances, and the Fischer assay water content.

Balances for both samples were in the range normally experienced for Pilot Plant tests. The only exception was for test number 213.1 which gave an extremely low value for the water balance. This was probably due to measurement error. The result also affects the material balance for that test.

3.6.10 Elemental Balances

The carbon, hydrogen and sulfur balances are also completed.

With respect to the carbon and hydrogen balances, although the deviations observed were not large, our experience with the Irati oil shale has shown that these balances nearly always give recoveries above 100 %, which indicates a systematic error towards an overvaluation in the carbon and the hydrogen leaving the system.

On the contrary, sulfur balance values are mostly below 100% indicating a systematic error for undervaluation of this element leaving the system. For the New Brunswick oil shale, this tendency was even greater due to its low sulfur content.

The organic carbon conversion to products for the Dolomite Marlstone Zone sample and Albert Mines Zone sample are respectively around 68 and 80 %. These values are significantly higher than the values observed for the Irati oil shale which averages about 55 % conversion.

The pyritic sulfur conversion for the Albert Mines Zone sample is around 75% which is very similar to the value observed for the Irati oil shale at a pyrolysis temperature of 500 C. For the Dolomite Marlstone Zone sample the conversion was 96 %.

3.6.11 Energy Balance

The data on thermal balances (in the appendix) and summarized in table 3.5.5 were calculated from operation variables obtained in the tests.

The retorted shale outlet temperature is corrected because the thermocouple reading is affected by the cold recycle gas that enters the bed.

The difference between the actual solids temperature and the measured temperature is defined as the approach. It is about 25 C.

The specific heats of the raw and retorted shale were assumed to be similar to Irati oil shale.

The decomposition heats for kerogen and minerals in the retorting temperature range were unknown. For the purpose of balance calculations, the following values were assumed: 2.3 cal/g of dry raw shale for the kerogen decomposition, 329 cal/g of H_2S formed by the pyrite reactions and 2820 cal/g of mineral carbon decomposed.

The decomposition of carbonate was not considered for the Albert Mines Zone sample. The Dolomite Marlstone Zone sample clearly showed evidence of this kind of reaction, as described in section 2.5 and 3.6.8.

The heat balances from the retort showed heat demand values in the range of 102 to 138 kcal/Kg of raw shale for the Dolomite Marlstone Zone sample and in the range of 99 to 127 kcal/kg of raw shale for the Albert Mines Zone sample.

The total energy input, energy output and heat demand (Table 3.5.5) are generally lower for the first test of each run due to the variation of the retorted shale outlet temperature because the cooling bed would not have yet attained steady state conditions, as described in section 3.4.3.

Comparing only the results for tests number 212.2 and 213.3 where the cooling bed had attained a stable temperature profile, the heat demand for the Dolomite Marlstone Zone sample was about 10% higher than for the Albert Mines Zone sample. The Dolomite Marlstone Zone sample requires about 15% higher heat demand than does Irati oil shale.

3.6.12 Product and Residue Properties

For comparative purposes, the average values of the main properties of the products and residue obtained in the Pilot Plant tests for the two samples of New Brunswick oil shale are shown in the tables 3.6.1 to 3.6.4.

The Albert Mines Zone shale oil is slightly different from the Dolomite Marlstone Zone shale oil. It has lower density, lower ramsbotton carbon and a higher pour point. Based on these properties, its oil seems to be more paraffinic than the Dolomite Marlstone Zone shale oil.

From the point of view of upgrading, both oils will require similar treatmens since they contain about the same amount of sulfur and nitrogen.

The product gases are quite different from each zone. The amount of CO2 is 330% higher and the gross heating value 45% lower for the Dolomite Zone. The gas from the Dolomite Marlstone Zone sample exhibits low relative values for hydrocarbons from methane to C5 plus due to the dilution by CO2.

The retor water chemistry from both New Brunswick oil shale samples is very similiar.

With respect to the retorted shales the major difference was related to the mineral carbon contents. The values demonstrate significate carbonate decomposition for the Dolomite Marlstone Zone sample.

Both samples showed relatively low gross heating values.

TABLE 3.6.1

COMPOSITE OIL AVERAGE PROPERTIES

PROPERTY	UNIT	DOLOMITE MARLSTONE ZONE SAMPLE	ALBERT MINES ZONE SAMPLE
Density 20/4 C	-	.931	.910
Viscosity - 38 C	cSt	41	25
54 C	cSt	21	13
Ramsbottom Carbon	wt%	3.3	2.0
Total Carbon	wt%	85.1	84.9
Hydrogen	wt%	11.8	12.0
Sulfur	wt%	.78	.78
Nitrogen	wt%	1.15	1.06
Flash Point	C	40	31
Pour Point	C	0	15
Gross Heating Value	cal/g	10200	10370

TABLE 3.6.2

GASES AVERAGE PROPERTIES

PROPERTY	UNIT	DOLOMITE MARLSTONE ZONE SAMPLE	ALBERT MINES ZONE SAMPLE
Composition			
. H_2S	Vol%	2.3	2.6
. O_2	Vol%	.3	.2
. N_2	Vol%	8.2	11.2
. CO	Vol%	.7	1.4
. CO_2	Vol%	29.3	8.8
. H_2	Vol%	33.9	32.0
. C_1	Vol%	11.3	17.3
. C_2	Vol%	4.3	8.4
. C_3	Vol%	3.0	5.8
. C_4	Vol%	2.2	4.1
. C_5^+	Vol%	1.4	3.8
Molecular weight	g/g mol	24.1	22.8
Gross heating value	cal/g	4460	8070

TABLE 3.6.3

RETORT WATER AVERAGE PROPERTIES

PROPERTY	UNIT	DOLOMITE MARLSTONE ZONE SAMPLE	ALBERT MINES ZONE SAMPLE
Sulfur	g/l	2.1	5.6
Ammoniacal nitrogen	g/l	5.6	6.8
Oil	g/l	.15	.18
Phenols	ppm	150	159
pH a 25 C	-	8.6	9.1

TABLE 3.6.4

RETORTED SHALE AVERAGE PROPERTIES

PROPERTY	UNIT	DOLOMITE MARLSTONE ZONE SAMPLE	ALBERT MINES ZONE SAMPLE
Screen analysis	wt%		
- 3/4" + 1/2"		36.7	14.5
- 1/2" + 1/4"		43.5	36.3
- 1/4" + 1/8"		9.2	14.9
- 1/8"		10.6	34.3
Fischer Assay	wt%		
- Oil		0.00	.10
- Water		.42	.53
- Gas + Loss		.06	.02
Total Carbon	wt%	5.5	6.5
Mineral Carbon	wt%	2.6	3.1
Total Hydrogen	wt%	.5	.5
Total Sulfur	wt%	.7	.7
Gross Heating Value	cal/g	280	320

NEW BRUNSWICK OIL SHALE

TECHNOLOGICAL CHARACTERIZATION

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TECHNICAL REPORT

CHAPTER 4 - CONCLUSIONS AND RECOMMENDATIONS

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4.1 CONCLUSIONS

The two New Brunswick shale samples show some differences in mechanical strength to abrasion and in particle sphericity. The mechanical strength is slightly higher for the Dolomite Marlstone Zone. Sphericity is lower for the Albert Mines Zone sample due to its lamellar characteristic. In spite of these differences, the results are still within the range of values for oil shales previously tested by the PETROSIX Process.

The Albert Mines Zone sample exhibits a moderately high level of thermal degradation. It fractures and has a higher potential to generate fines on retort.

The Dolomite Marlstone Zone sample shows evidence of carbonate decomposition reactions in the temperature range corresponding to organic matter liberation. This was seen in the TGA analyses, and confirmed by analyses of the gas from the Fischer assay, and also by retorted shale mineral carbon content.

The two samples reacted differently in the Pilot Plant retorting tests. The largest difference was in the average processing rate. No difficulty resulted for the programmed processing rate of the Dolomite Marlstone Zone sample. The retorting rate for the Albert Mines Zone sample was lower than the desired level due to the effects of thermal degradation. In spite of the few tests made, and without considering the possibility of trying a more favorable feed size distribution for this sample, the results suggest that the recommended processing rate is about 2.000 kg/h m2.

The Pilot Plant showed a smooth operation and high retorting efficiency for both samples as indicated by the values of product yields obtained. For the Dolomite Marlstone Zone sample the oil and gas yields were respectively in the ranges of 95 to 98% and 126 to 128% of Fischer assay. For the Albert Mines Zone sample, the values for oil and gas yields were respectively 100 to 103% and 87 to 92% of Fischer assay.

The thermal balances for the retort indicated a thermal demand 10% higher for the Dolomite Marlstone Zone sample. This is due to mineral carbonate decomposition even for pyrolysis temperatures limited to 500 C.

The physical and chemical properties of the composite oils from the two samples were slightly different. The oil from the Albert Mines Zone seems to be lighter and more paraffinic as indicated by its density, ramsbottom carbon residue and pour point. From the point of view of upgrading, both oils will require similar treatment, since they contain about the same amount of sulfur and nitrogen.

Finally, it can be concluded that both samples of the New Brunswick shale can be processed by the Petrosix Pilot retort. It has to be pointed out however that, due to the difference in behavior observed during the Pilot plant retorting tests, the Albert Mines Zone shale will retort at a rate slightly lower than that practiced with the Irati shale and that attained with the Dolomite Marlstone Zone shale.

4.2 RECOMMENDATIONS

The data obtained from the Pilot Plant should not be used directly for industrial plant evaluation purposes, since commercial size parameters may only be established by correlation of pilot and UPI plant data. This would include the characterization tests and also running simulation models at selected conditions.

The technological characterization and Pilot Plant tests show that the PETROSIX Process is suitable for the New Brunswick oil shales. It is recommended that preliminary design and cost estimates for a larger plant be initiated to assess the economic feasability. This is considered essential to evaluate the atractiveness of an industrial scale oil shale retorting installation.

For the definitive design and cost estimate of commercial plant, it is absolutely essential to perform tests in the demonstration plant. Only after these tests, would PETROBRAS be able to issue a performance guarantee for the PETROSIX Process for the retorting of New Brunswick oil shales.

Finally, it was noted in section 2.5 that the shale from the Albert Mines Zone may have been weathered. Experience with Irati Formation oil shales show that weathering affects the design in the shale preparation area. Future bulk sampling of this shale should take this into consideration.

NEW BRUNSWICK OIL SHALE

TECHNOLOGICAL CHARACTERIZATION

AND

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TECHNICAL REPORT

CHAPTER 5 - APPENDIX

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5.1 - SAMPLE SHIPMENT DOCUMENTS

THREE-D
GEOCONSULTANTS
LIMITED

P.O Box 3133, Station B, Fredericton, N.B. E3A 5G9
Suite B4, 100 Prospect Street West
Tel: (506) 453-7700

6 October 1988

Petroleo Brasilerio S.A.
Avenue Republica do Chile 65-S/2157
Rio de Janiero, R.J.
Brasil 20035

Attention: Osmar Ivo

Dear Mr. Ivo:

Re: New Brunswick Oil Shale Sample
-Stone and Webster Eng. Corp.

Attached are 2 original Bills of Lading and 4 Non Negotiable Bills of Lading for the oil shale shipment. The material is packaged in 30-45 gallon steel drums, loaded 4 to a pallet (8 pallets, 1 with 2 drums) in a 20 foot container (Container No. 2315460; seal C589680). The ship, the Columbus Ohio, is due to arrive in Paranagua on October 16th.

The oil shales shipped represent two rock units, the Albert Mines Zone and the dolomite marlstone zone. The shipment consists of 15 drums of shale from each unit. Fischer Assays of shale samples representing each group of drums shipped are attached for your information. Calorific values and the calcium and magnesium content of the shales will be forwarded upon receipt from the lab.

I trust this is to your satisfaction. Please contact me or Ed Piper of Stone and Webster if any questions arise.

Yours truly,

THREE-D GEOCONSULTANTS LIMITED

D. Ball

F. Dwight Ball
Senior Geologist

FDB:bc

cc: Dr. E. Yildirim, General Manager, New Technology, Coal and Minerals, Canadian Occidental Petroleum Ltd., 1500, 635-8th Ave. S.W. Calgary, Alberta T2P 3Z1

Mr. E.M. Piper, Stone and Webster Engineering Corp., 5555 Greenwood Plaza Blvd., Englewood, Colorado, U.S.A. 80111

Drum #	Rock Unit	Fischer Assay Imp. gal/ton	U.S. gal/ton	litre/tonne
A-1-A	Albert Mines	26.5	31.8	132.7
A-1-B	"			
A-1-C	"			
A-1-E	"			
A-2-A	"	27.4	32.9	137.3
A-2-B	"			
A-2-D	"			
A-3-A	"	25.3	30.4	126.8
A-3-C	"			
A-3-E	"			
A-4-B	"	21.5	25.8	107.6
A-4-D	"			
A-5-A	"	24.5	29.4	122.7
A-5-C	"			
A-5-E	"			
D-1-A	dolomite marlst.	13.5	16.2	67.6
D-1-B	"			
D-1-C	"			
D-2-A	"	13.6	16.3	68.0
D-2-B	"			
D-3-A	"	15.3	18.4	76.8
D-3-C	"			
D-4-B	"	12.3	14.8	61.7
D-5-A	"	13.4	16.1	67.2
D-5-C	"			
D-6-B	"	11.3	13.5	56.3
D-7-A	"	8.0	9.6	40.1
D-8-B	"	16.1	19.3	80.5
D-9-A	"	17.2	20.7	86.4
D-10-B	"	17.1	20.5	85.5

Item #	Rock Unit	Calcium (%)	Magnesium (%)	Sulphur (%)	Water Yield (litres/tonne)	Oil Yield (litres/tonne)	Heat (BTU/lb.)
A-1-A	Albert Mines	5.10	0.60	1.23	22	132.8	3308
A-1-B	"						
A-1-C	"						
A-1-E	"						
A-2-A	"	5.68	0.80	0.92	33	137.3	3080
A-2-B	"						
A-2-D	"						
A-3-A	"	7.35	0.89	1.05	30	125.6	2854
A 3 C	"						
A-3-E	"						
A-4-B	"	7.77	0.78	0.80	29	107.7	2829
A-4-D	"						
A-5-A	"	7.87	0.99	0.99	30	122.8	2628
A-5-C	"						
A-5-E	"						
D-1-A	dolomite marlst.	7.35	3.71	0.63	18	67.6	1239
D-1-B	"						
D-1-C	"						
D-2-A	"	7.38	1.44	0.69	11	68.1	1436
D-2-B	"						
D 3 A	"	4.57	1.81	0.94	7	76.7	1777
D-3-C	"						
D-4-B	"	2.80	1.07	0.96	10	61.6	1641
D-5-A	"	2.73	1.07	0.96	16	67.1	1650
D 5-C	"						
D-6-B	"	5.41	2.50	0.80	14	56.6	3161
D-7-A	"	3.81	1.42	0.95	10	40.1	1942
D-8-B	"	4.31	1.57	1.54	9	80.7	2143
D-9-A	"	4.55	2.30	1.21	12	86.2	1916
D 10-B	"	5.31	2.26	1.61	8	85.7	1902

5.2 - DESCRIPTION OF METHODS USED IN THE OIL SHALE ANALYSES

5.2 - DESCRIPTION OF METHODS USED IN THE OIL SHALE ANALYSES

I - RAW AND SPENT SHALE

1. Sieve analysis of coal

   ASTM D-410-84

2. Relative density and porosity of lump coke

   ASTM D-167-73 (1979)

   The relative density and true relative density of oil shale particle were analyzed by this standard ASTM method.

3. Cubic foot weight of crushed bituminous coal

   ASTM D-291-60 (1980)

   This method was used to evaluated the bulk density of crushed oil shale lumps, with top size of 3/4".

4. Resistance to abrasion of small size coarse aggregate by use of the Los Angeles machine

   ASTM - D-131-69 (discontinued)

   The discontinued ASTM method was adapted to oil shales as follows:

   . The abrasive charge in the assays was made of 12 steel spheres with a total weight of 5000 ± 25 g.

   . The non-washed sample was oven-dried at 65 to 70 C to substantially constant weight, separated into individual size fraction as follows:

     . 3/4" to + 1/2"
     . 1/2" to + 1/4"

   . Recombination of individual size fractions was not performed, so each fraction was assayed separately. The weight of each sample fraction prior to test was 5000 ± 5 g.

- The number of revolutions of the Los Angeles abrasion testing machine was 350, at a speed of 30 to 33 rpm. After the test, the discharged sample was screened on a 1/4" sieve for two minutes.

5. Modified permeability test

This test is performed on equipment consisting of a fan, valve, orifice plate flowmeter, test chamber and two water manometers.

The procedure begins by loading the material for the test into a chamber having an area of 0.0929 m2 and a depth of 1 meter.

The size fraction of the charge is selected according to the test purpose.

The fan is started and the air flows through the bed causing a pressure drop of 72.3 cm of water in the chamber test. At this point the air flow is read from the flowmeter.

The permeability index is defined as the number of Nm3/min of air flowing through a column of material 1 meter high with a 0.5 m2 surface area at a pressure difference of 0.07 atmosphere.

This definition is slighty different from that internationally adopted because a column pressure drop of 0.07 atm was used instead of 0.1 atm.

6. Moisture analyses for sample of coal and coke

ASTM D-3173-85

Glass capsules with ground-glass caps were used in this analyses.

7. Oil from oil shale (resource evaluation by the USBM Fischer Assay Procedure)

ASTM D-3904-80

The main differences from the standard method are:

- Normally the relative density in not measured. A solvent such as toluene is added to the centrifuge tube in order that the volume of water may be read.

- Prior to weighing and retorting, the sample is oven-dried at 100 C for at least two hours.
- The sample weighed for analysis is 50 ± 5 g.

8. Gross calorific value of solid fuel by the adiabatic bomb calorimeter

ASTM D-2015-77 (1978)

9. Carbon and hydrogen analysis for samples of coal and coke

ASTM D-3178-84

10. Carbon dioxide in coal

ASTM D-1756-84

11. Total sulfur analysis for samples of coal and coke

ASTM D-3177-84

The Eschka and High-Temperature combustion methods were used in the oil shale sulfur analysis, as described in the ASTM standard method.

12. Forms of sulfur in coal

ASTM D-2492-84

Forms of sulfur were analyzed according to this standard method.

13. Nitrogen analysis for sample of coal and coke

ASTM D-3179-84

14. Tumbler Test for coal

ASTM D-441-45

The test is done on retorted oil shale. The modifications from the standard method are on the jar revolution time. it is decreased to 30 minutes, from 1 hour, and the particles size used for the test was 1/2' to 3/4".

15. Ash analysis for samples of coal and coke

ASTM D-3174-82

16. Analysis of coal and coke ash

ASTM D-2795-84

17. Sulfur in ash from coal and coke

ASTM D-1757-80

18. Loss on ignition

The pre-dried sample is heated to 950 C in an air stream and maintained at this temperature for 1 hour.

II - HEAVY AND COMPOSITE OILS

1. Density and relative density (specific gravity) of liquids by lipkin bicapillary picnometer

ASTM D-941-83

2. Carbon and hydrogen

Analysis is made by burning a weighed quantity of sample in a closed system and fixing the products of combustion in an absorption train after complete oxidation and purification from interfering substances.

3. Total nitrogen in lubricant oils and fuel oils by the modified Kjeldahl method

ASTM D-3228-83

4. Sulfur in petroleum products (General Bomb Method)

ASTM D-129-64 (1978)

5. Heat of combustion of liquid hydrocarbon fuels by bomb calorimeter

ASTM D-240-76 (1980)

6. Pour point of petroleum oils

ASTM D-97-66 (1978)

7. Ramsbotton carbon residue of petroleum products

ASTM D-524-81

8. Water in petroleum products and bitominous materials by distillation

ASTM D-95-83

9. Solids content

Solids content is determined by a combined extraction-centrifugation technique with industrial grade toluene as a solvent. A weighed quantity of sample in a centrifuge tube is successively washed with toluene and centrifuged until the solvent extract shows complete oil removal from solids. Solids content (solids plus toluene insolubles) is obtained by solvent evaporation (105 C) of residue and reported as weight %.

10. Ash from petroleum products

ASTM D-482-80

11. Distillation

ASTM D-285-62 (1978) and ANSI/ASTM D-1160-77

D-285 distillation was conducted up to a predetermined temperature reading of 204 C.

12. Kinematic viscosity of transparent and opaque liquids (and the calculation of dynamic viscosity)

    ASTM D-445-83

III - LIGHT OIL

1. Density, specific gravity or API gravity of Crude Petroleum and Liquid Petroleum products by hydrometer method

   ASTM D-1298-80

2. Distillation of petroleum products

   ASTM D-86-82

IV - RETORT WATER

1. pH of water

   ASTM D-1293-84

2. Total fixed solids

   This determination was conducted by evaporating a measured volume of sample. The dry residue was ignited in a muffle furnace at 600 C. The fixed matter is reported as total solids content, g/l.

3. Ammonia nitrogen in water

   ASTM D-1426-79

4. Oil content

   The determination of oil content in retort water was based on discontinued ASTM D-2778-70 "Solvent extraction of organic matter from water", using petroleum ether as a solvent.

5. Phenols

Phenols content in retort water was determined according to 4-aminoantipyrine method (Standard Methods for the examination of water and waste water).

6. Sulfur

Retort water sulfur was determined by precipitating the sulfur as sulfate after oxidation. The procedure is based on ASTM D-516-82 method "Sulfate ion in water and waste water".

V - GAS

1. Gas composition

Oil shale gas was analyzed by thermal conductivity gas chromatography.

2. Calculating calorific value and specific gravity of gaseous fuels

ASTM D-3588-81

5.3 - PILOT PLANT SAMPLE HANDLING

5.3 - PILOT PLANT SAMPLE HANDLING

1. Raw and retorted shale

Figures 5.3.1 and 5.3.2 show diagrammatically the method of preparing of raw and retorted shale samples for laboratory analyses. In addition to the samples indicated in figure 5.3.2 about 200 kilograms of retorted shale from test numbers 212.1 and 213.1 were sent to New Brunswick Department of Natural Resources and Energy in Fredericton, New Brunswick.

2. Shale oil

2.1 Sample handling

Figures 5.3.3 to 5.3.6 show the method of preparing shale oil samples for laboratory analyses.Individual shale oil streams were analyzed as received from Pilot Plant. Proportional fractions of collected oils according to yields made up the clean composite oil. This oil was then cleaned by centrifuging and distillation in order to give a clean composite oil sample for analyses.

2.2 Oil cleaning for analyses

2.2.1 Cyclone oil

This fraction was dissolved in petroleum ether. It was then centrifuged at 2000 rpm, to separate water and solids. The oil extract was then gently heated to no more than 40 C to evaporate the petroleum ether.

2.2.2 Precipitator oil

Water is the major contaminant of this fraction. Dehydration of the sample was made to collect water plus distilled oil.

2.3 Composite oil samples cleaning

To produce a composite oil sample for each New Brunswick oil shale samples, oil fractions, as indicated in figures 5.3.3 to 5.3.5, were mixed to form dirty oil samples. The oil sample from the Dolomite Marlstone Zone sample was formed from oils produced in test numbers 212.1 and 212.2. For the Albert Mines Zone sample, the dirty oil was from test numbers 213.1 to 213.3.

The two dirty oil samples were cleaned in a small press filter. The water was decanted and the cleaned oil packed in drums to be sent to Canada.

FIGURE 5.3.1

NEW BRUNSWICK OIL SHALE
RAW SHALE SAMPLING AND HANDLING

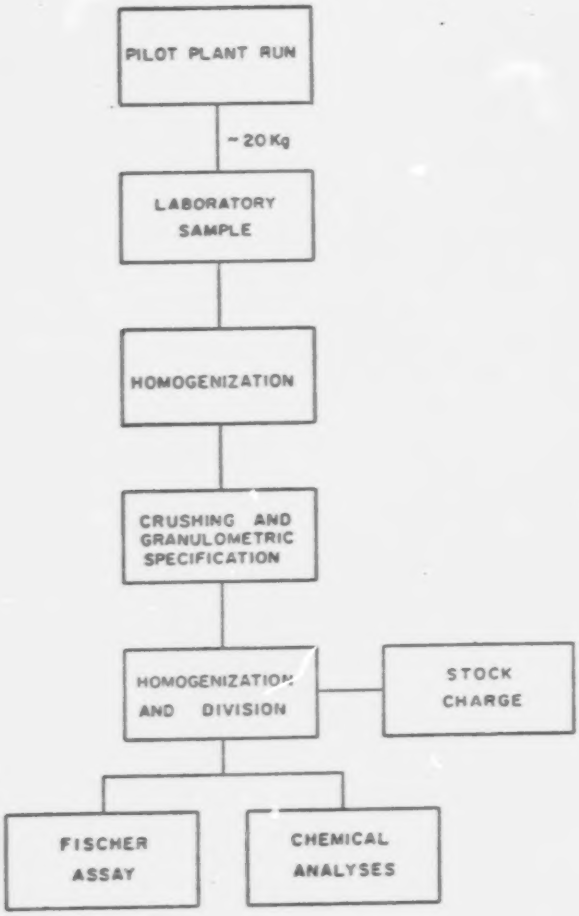


FIGURE 5.3.2

NEW BRUNSWICK OIL SHALE
RETORTED SHALE HANDLING AND SAMPLING

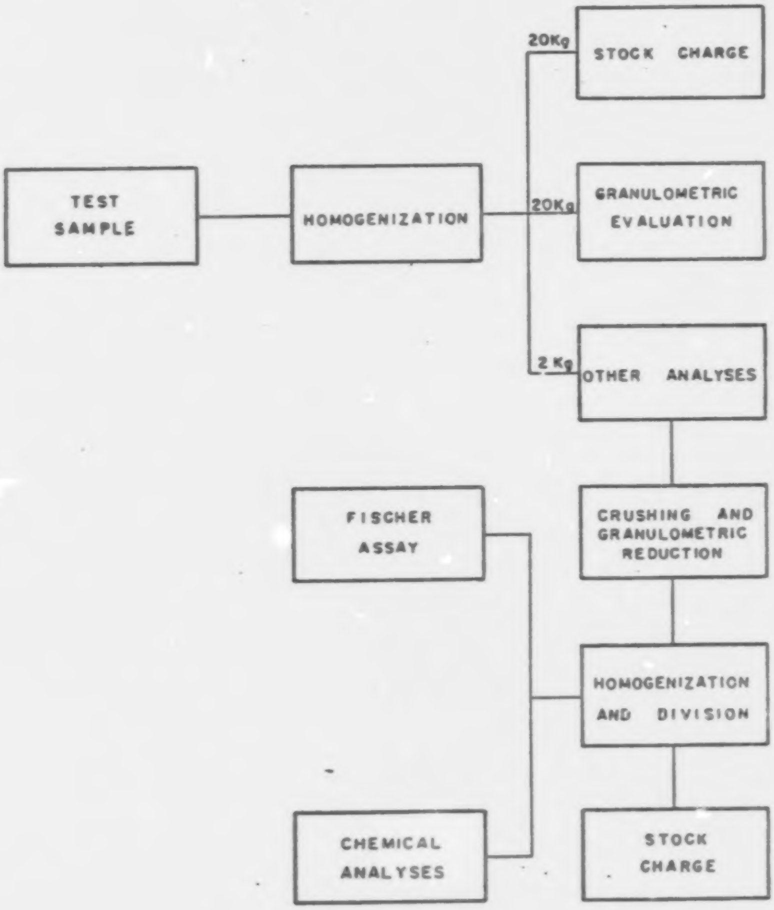


FIGURE 5.3.3

NEW BRUNSWICK OIL SHALE
CYCLONE OIL SAMPLING AND HANDLING

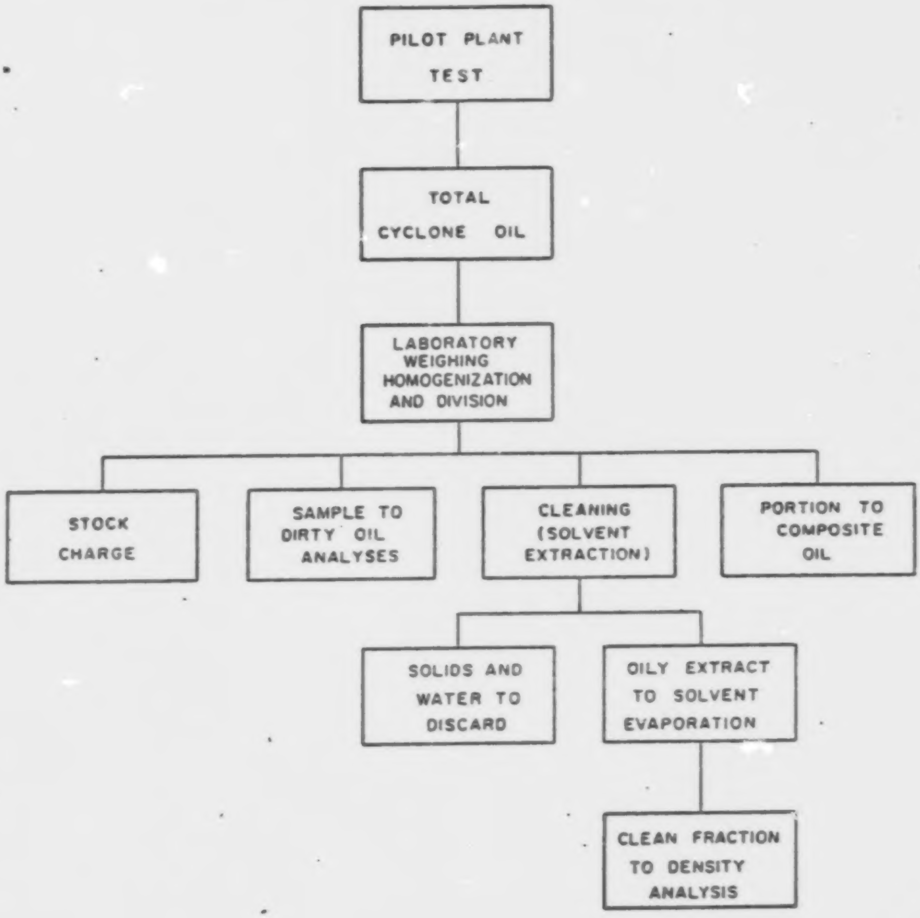

PILOT PLANT TEST
TOTAL CYCLONE OIL
LABORATORY WEIGHING HOMOGENIZATION AND DIVISION
STOCK CHARGE
SAMPLE TO DIRTY OIL ANALYSES
CLEANING (SOLVENT EXTRACTION)
PORTION TO COMPOSITE OIL
SOLIDS AND WATER TO DISCARD
OILY EXTRACT TO SOLVENT EVAPORATION
CLEAN FRACTION TO DENSITY ANALYSIS

FIGURE 5.3.4

NEW BRUNSWICK OIL SHALE
PRECIPITATOR OIL SAMPLING AND HANDLING

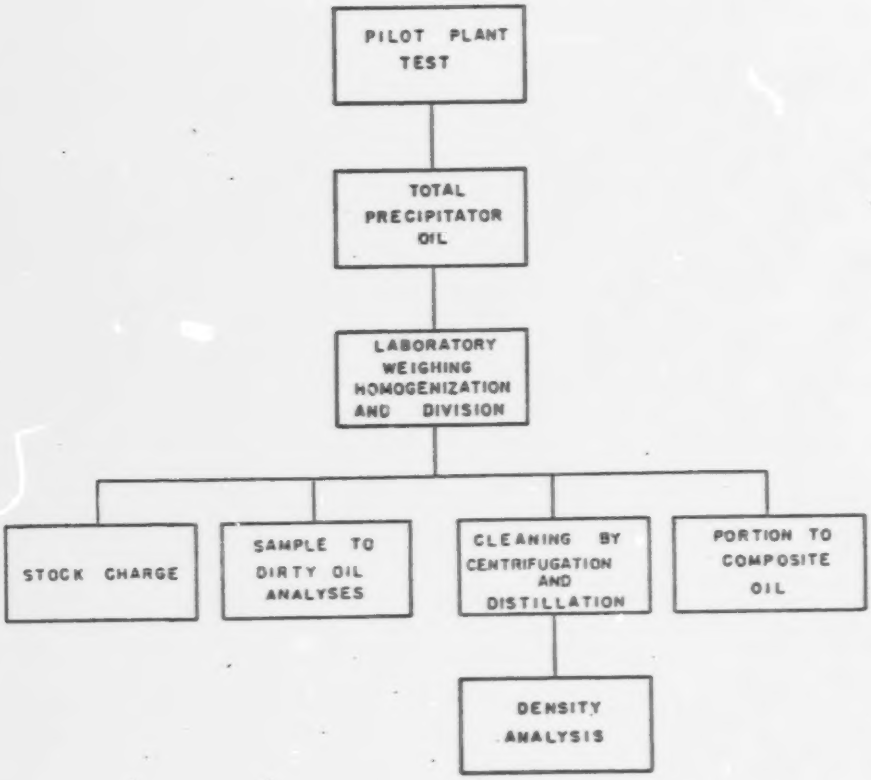

PILOT PLANT TEST
TOTAL PRECIPITATOR OIL
LABORATORY WEIGHING HOMOGENIZATION AND DIVISION
STOCK CHARGE
SAMPLE TO DIRTY OIL ANALYSES
CLEANING BY CENTRIFUGATION AND DISTILLATION
PORTION TO COMPOSITE OIL
DENSITY ANALYSIS

FIGURE 5.3.5

NEW BRUNSWICK OIL SHALE
LIGHT OIL SAMPLING AND HANDLING

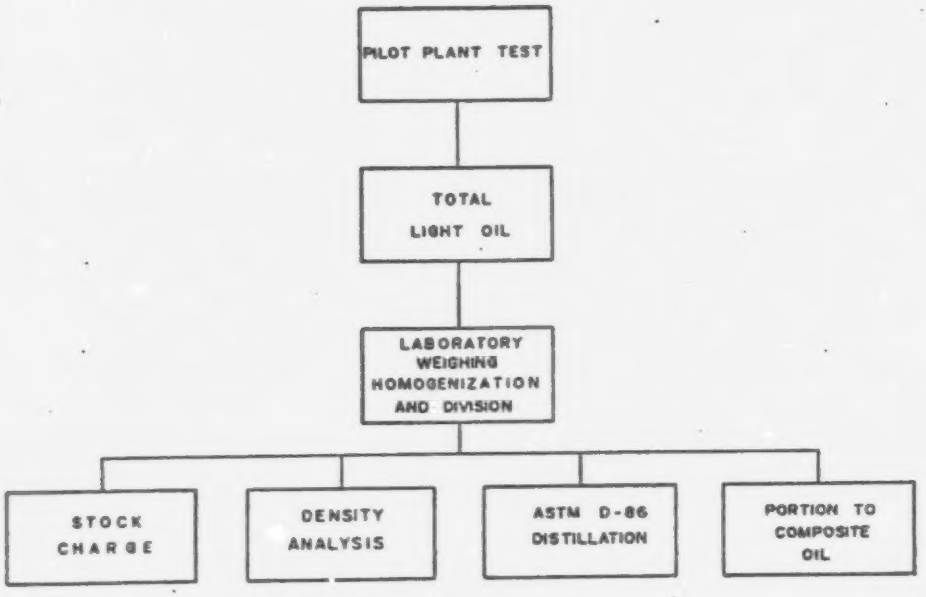
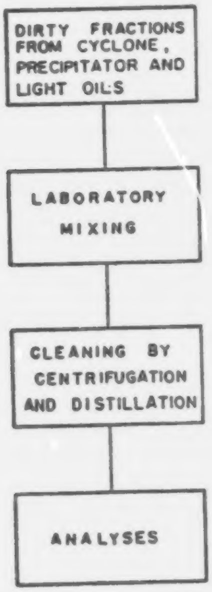


FIGURE 5.3.6

NEW BRUNSWICK OIL SHALE
COMPOSITE OIL HANDLING AND SAMPLING


DIRTY FRACTIONS FROM CYCLONE, PRECIPITATOR AND LIGHT OILS
LABORATORY MIXING
CLEANING BY CENTRIFUGATION AND DISTILLATION
ANALYSES

5.4 - SUMMARY OF TEST DATA

```
S I X / S E S I X                                                                      R0457001

UNIDADE PILOTO    -   RESUMO DE DADOS                                                  PAGINA  1/7
(PILOT PLANT)     -   (MAIN RESULTS)                                                   (PAGE)   NUMBER
--------------------------------------------------------------------------------------------------------------

NUMERO DO TESTE (NUMERO.SERIE) (TEST NUMBER)

INICIO DO TESTE - DATE OF TEST

INICIO DO TESTE - STARTING TIME

DURACAO DO TESTE (HH.MM) (DECIMAL) - (TEST DURATION (HOURS. MINUTES))

ORIGEM DA CARGA  - SHALE ORIGIN

FAIXA GRANULOMETRICA DA CARGA - (FEED SIZE RANGE).

ALTURA DO LEITO DE PIROLISE (METROS) - (PYROLYSIS BED HEIGHT) (METERS)

ALTURA DO LEITO DE RESFRIAMENTO (METROS) - (COOLING BED HEIGHT)

VELOCIDADE DE RETORTAGEM (KG/H.M2) - (RETORTING RATE)

VELOCIDADE DE RETORTAGEM (LB/H.FT2) - (RETORTING RATE)

TEMPERATURA DE PIROLISE (TR-3/5) ('C) -(PYROLISIS TEMPERATURE)

TEMPERATURA DE SAIDA DOS GASES (TR-10) ('C) -(RETORT OFF-GAS TEMPERATURE)

RELACAO G/X (GAS/XISTO CRU UMIDO) (KG/KG) - (RECYCLE GAS TO SHALE RATIO)

RELACAO DOS RECICLOS (RQ/RF) (KG/KG) - (HOT TO COLD RECYCLE GAS RATIO)

PERDA DE CARGA NO LEITO DE PIROLISE (CMHG) - (PYROLISIS BED PRESSURE DROP)

RENDIMENTO EM OLEO S/ENSAIO FISCHER (% PESO) - (OIL YIELD ON FISCHER ASSAY)

RENDIMENTO EM GAS S/ENSAIO FISCHER (% PESO)- (GAS YIELD ON FISCHER ASSAY)

RENDIMENTO EM OLEO+GAS S/ENSAIO FISCHER (% PESO) - (OIL + GAS YIELD ON FISCHER ASSAY)
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S I X  /  S E S I X                                                  R045/001

UNIDADE PILOTO   -   RESUMO DE DADOS                                 PAGINA  2/7
=====================================================================================
                                                                     TESTE - TEST NUMBER
  BALANCO DE MATERIAL - (MATERIAL BALANCE)
=====================================================================================

ENTRA: (IN)      - XISTO CRU UMIDO (KG/H) - (WET RAW SHALE)
                 - VAPOR DO PRECIPITADOR (KG/H) - (PRECIPITATOR STEAM)
                 - TOTAL ENTRANDO (KG/H) - (TOTAL)

SAI: (OUT)       - OLEO COMPOSTO LIMPO (KG/H) - CLEAN COMPOSITE OIL
                 - GAS PRODUTO SECO (KG/H) - (DRY PRODUCT GAS)
                 - AGUA TOTAL (KG/H) (TOTAL WATER)
                 - SOLIDOS ARRASTADOS (KG/H) - (ENTRAINED SOLIDS)
                 - XISTO RETORTADO (BAL. RETORTA)  (KG/H) - (RETORTED SHALE)
                 - TOTAL SAINDO (KG/H) - (TOTAL)
FECHAMENTO DO BALANCO MATERIAL (SAINDO/ENTRANDO) (%) - (OUT/IN RECOVERY)


=====================================================================================
  BALANCO DE AGUA - (WATER BALANCE)
=====================================================================================

ENTRA:       - AGUA DE UMIDADE (KG/H) - (MOISTURE WATER)
             - AGUA DE PIROLISE (KG/H) - (PYROLYSIS WATER)
             - VAPOR DO PRECIPITADOR (KG/H) - (ELECTRICAL PRECIPITATOR STEAM)
             - TOTAL ENTRANDO (KG/H) - (TOTAL)

SAI:(OUT)    - AGUA NOS OLEOS (KG/H) - (WATER IN THE OILS)
             - AGUA NO CONDENSADOR (KG/H) - (WATER IN CONDENSER)
             - AGUA NO GAS PRODUTO (KG/H) - (WATER IN PRODUCT GAS)
             - AGUA NO XISTO RETORTADO (KG/H) - (WATER IN RETORTED SHALE)
             - TOTAL SAINDO (KG/H) - (TOTAL)
FECHAMENTO DO BALANCO DE AGUA (SAINDO/ENTRANDO) (%) - (OUT/IN RECOVERY)
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                    S I X  /  E E S I X                                                          R0457001

                    UNIDADE PILOTO   -   RESUMO DE DADOS                                         PAGINA  3/7
==============================================================================================================
                    BALANCO DE CARBONO - (CARBON BALANCE)                                        TESTE- (TEST NUMBER)
==============================================================================================================

                    ENTRA: (IN)    - CARBONO NO XISTO CRU SECO (KG/H) - (CARBON IN DRY RAW SHALE)

                    SAI:  (OUT)    - CARBONO NO XISTO RETORTADO (KG/H) - (CARBON IN RETORTED SHALE)
                                   - CARBONO NO OLEO COMPOSTO (KG/H) - (CARBON IN COMPOSITE OIL)
                                   - CARBONO NO GAS PRODUTO (KG/H) - (CARBON IN PRODUCT GAS)
                                   - TOTAL SAINDO (KG/H) - (TOTAL)
                    FECHAMENTO DO BALANCO DE CARBONO (SAINDO/ENTRANDO) (%) - (OUT/IN RECOVERY)

==============================================================================================================
                    BALANCO DE HIDROGENIO - (HYDROGEN BALANCE)
==============================================================================================================

                    ENTRA: (IN)       - HIDROGENIO NO XISTO CRU SECO (KG/H) - (HIDROGEN IN DRY RAW SHALE)

                    SAI: (OUT)        - HIDROGENIO NO XISTO RETORTADO (KG/H) - (HYDROGEN IN RETORTED SHALE)
                                      - HIDROGENIO NO OLEO COMPOSTO (KG/H) - (HYDROGEN IN COMPOSITE OIL)
                                      - HIDROGENIO NO GAS PRODUTO SECO (KG/H) - (HIDROGEN IN PRODUCT GAS)
                                      - NA AGUA DE PIROLISE LIBERADA (KG/H) - (HIDROGEN IN PYROLISIS WATER)
                                      - TOTAL SAINDO (KG/H) - (TOTAL)
                    FECHAMENTO DO BALANCO DE HIDROGENIO (SAINDO/ENT.) (%) - (OUT/IN RECOVERY)

==============================================================================================================
                    BALANCO DE ENXOFRE - (SULFUR BALANCE)
==============================================================================================================

                    ENTRA: (IN)   - ENXOFRE NO XISTO CRU SECO (KG/H)  - (SULFUR IN DRY RAW SHALE)

                    SAI:          - ENXOFRE NO XISTO RETORTADO (KG/H)  - (SULFUR IN RETORTED SHALE)
                                  - ENXOFRE NO OLEO COMPOSTO (KG/H) - (SULFUR IN COMPOSITE OIL)
                                  - ENXOFRE NO GAS PRODUTO (KG/H) - (SULFUR IN PRODUCT GAS)
                                  - ENXOFRE NA AGUA DE RETORTAGEM (KG/H)- (SULFUR IN PYROLYSIS WATER)
                                  - TOTAL SAINDO (KG/H) - (TOTAL)
                    FECHAMENTO DO BALANCO DE ENXOFRE (SAINDO/ENTRANDO) (%) - (OUT/IN RECOVERY)
```

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S I X / S E S I X                                                                    R0457001

UNIDADE PILOTO   -   RESUMO DE DADOS                                                 PAGINA  4/7

==============================================================================================
        TEMPERATURAS - (TEMPERATURES)                                    TESTE - (TEST NUMBER)
==============================================================================================

        TEMPERATURA DO RF NA ENTRADA DA RETORTA (TIC-36) ('C) -    (COLD RECYCLE GAS IN RETORT INLET)
        TEMPERATURA DO RQ NA ENTRADA DA RETORTA (TR-25/27) ('C) - (HOT RECYCLE GAS IN RETORT INLET)
        TEMPERATURA DO XISTO RETORTADO (TR-07) ('C) - (RETORTED SHALE)
        TEMPERATURA DO TOPO DO LEITO (TR-09) ('C) - (SHALE TEMPERATURE NEAR THE GAS OUTLET)
        TEMPERATURA DO GAS PRODUTO UMIDO (TR-19) ('C) - (WET PRODUCT GAS)

==============================================================================================
        PRESSOES - (PRESSURES)
==============================================================================================

        PRESSAO NO FUNDO DA RETORTA (PR-07) (CMHG) - (RETORTED SHALE OUT LET)
        PRESSAO NO MEIO DO LEITO DE RESFRIAMENTO (PR-06) (CMHG) - (INTERMEDIATE COOLING BED)
        PRESSAO NO LEITO DE PIROLISE INJETOR INF (PR-05) (CMHG) -  PYROLYSIS BED (INFERIOR INJECTOR)
        PRESSAO NO LEITO DE PIROLISE INJETOR INT (PR-04) (CMHG) -  PYROLYSIS BED (INTERMEDIATE INJECTOR)
        PRESSAO NO LEITO DE PIROLISE INJETOR SUP (PR-03) (CMHG) -  PYROLYSIS BED (SUPERIOR INJECTOR)
        PRESSAO NO LEITO DE PIROLISE NIVEL MEDIO (PR-02) (CMHG) - (INTERMEDIATE IN PYROLYSIS BED)
        PRESSAO NO TOPO DO LEITO (PR-01) (CMHG) - (NEAR THE GAS OUTLET)
        PRESSAO NA SAIDA DOS GASES DA RETORTA (PRC-08) (CMHG) - (IN THE GAS OUTLET)
        PRESSAO NA SUCCAO DO COMPRESSOR (PRC-09) (CMHG) - (COMPRESSOR SUCTION)

==============================================================================================
        VAZOES - (RATES)
==============================================================================================

        VAZAO DE XISTO CRU UMIDO (KG/H) - (WET RAW SHALE)
        VAZAO DE XISTO CRU SECO (KG/H)  - (DRY RAW SHALE)
        VAZAO DE OLEO DO CICLONE (SUJO) (KG/H) -  CYCLONE OIL (DIRTY)
        VAZAO DE OLEO DO CICLONE (LIMPO) (KG/H)-  CYCLONE OIL (CLEAN)
        VAZAO DE OLEO DO PRECIPITADOR (SUJO) (KG/H) - PRECIPITATOR OLL (DIRTY)
        VAZAO DE OLEO DO PRECIPITADOR (LIMPO) (KG/H) - PRECIPITATOR OL L (CLEAN)
        VAZAO DE OLEO LEVE (KG/H)  - (LIGHT OIL)
        VAZAO DE AGUA DE RETORTAGEM (TOTAL) (KG/H) - (RETORTING WATER)
        VAZAO DE GAS PRODUTO UMIDO (KG/H) - (WET PRODUCT GAS)
        VAZAO DE GAS DE RECICLO QUENTE (KG/H) - (HOT RECYCLE GAS)
        VAZAO DE GAS DE RECICLO FRIO (KG/H)  - (COLD RECYCLE GAS)
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S I X / S E S I X                                                                   R0457001

UNIDADE PILOTO   -   RESUMO DE DADOS                                                PAGINA  5/7

=============================================================================================
PROPRIEDADES DOS FLUXOS (STREAMS PROPERTIES)                                TESTE (TEST NUMBER)
=============================================================================================

GRANULOMETRIA DA CARGA (- 1    + 3/4) (SCREEN ANALYSIS)
GRANULOMETRIA DA CARGA (- 3/4 + 1/2) (SCREEN ANALYSIS)
GRANULOMETRIA DA CARGA (- 1/2 + 1/4) (SCREEN ANALYSIS)


XISTO CRU - UMIDADE (% PESO) (RAW SHALE) MOISTURE CONTENT (W.b), WT %
XISTO CRU - ENSAIO FISCHER - OLEO (% PESO) FISCHER ASSAY - OIL (d.b), WT %
XISTO CRU - ENSAIO FISCHER - AGUA (% PESO) WATER (d.b) WT %
XISTO CRU - ENSAIO FISCHER - GAS+PERDAS (% PESO) GAS + LOSS (d.b), WT %
XISTO CRU - ENSAIO FISCHER - RESIDUO (% PESO) RETORTED SHALE (d.b), WT %
XISTO CRU - PERDA AO FOGO (% PESO) LOSS BY BURNING AT 950°C, (d.b), WT %
XISTO CRU - CARBONO TOTAL (% PESO) TOTAL CARBON (d.b), WT %
XISTO CRU - CARBONO MINERAL (% PESO) MINERAL CARBON (d.b), WT %
XISTO CRU - HIDROGENIO TOTAL (% PESO) TOTAL HYDROGEN (d.b) WT %
XISTO CRU - ENXOFRE (% PESO) SULFUR (d.b),WT %
XISTO CRU - PODER CALORIFICO SUPERIOR (KCAL/KG) GROSS HEATING VALUE

(RETORTED SHALE)
XISTO RETORTADO - ENSAIO FISCHER - OLEO (% PESO) FISCHER ASSAY - OIL
XISTO RETORTADO - ENSAIO FISCHER - AGUA (% PESO) FISCHER ASSAY - WATER
XISTO RETORTADO - ENSAIO FISCHER - GAS+PERDAS (% PESO) FISCHER ASSAY - GAS + LOSS
XISTO RETORTADO - ENSAIO FISCHER - RESIDUO (% PESO) FISCHER ASSAY - RETORTED SHALE
XISTO RETORTADO - PERDA AO FOGO (% PESO) LOSS BY BURNING AT 950 °C
XISTO RETORTADO - CARBONO TOTAL (% PESO) TOTAL CARBON
XISTO RETORTADO - CARBONO MINERAL (% PESO) MINERAL CARBON
XISTO RETORTADO - HIDROGENIO TOTAL (% PESO) TOTAL HYDROGEN
XISTO RETORTADO - ENXOFRE (% PESO) SULFUR
XISTO RETORTADO - PODER CALORIFICO SUPERIOR (KCAL/KG) GROSS HEATING VALUE


OLEO DO CICLONE SUJO - AGUA (% PESO) CYCLONE OIL (DIRTY) - WATER, WT %
OLEO DO CICLONE SUJO - SOLIDOS (% PESO) CYCLONE OIL (DIRTY) - SOLIDS, WT %
OLEO DO CICLONE LIMPO - DENSIDADE 20/4 ('C) CYCLONE OIL (CLEAN) - DENSITY 20/4 °C
OLEO DO CICLONE LIMPO - VISCOSIDADE A 54.4'C (CS) CYCLONE OIL (CLEAN) - VISCOSITY AT 54.4 °C
OLEO DO CICLONE LIMPO - VISCOSIDADE A 98.9'C (CS) CYCLONE OIL (CLEAN) - VISCOSITY AT 98.9 °C
OLEO DO PRECIPITADOR SUJO - AGUA (% PESO) PRECIPITADOR OIL (DIRTY) - WATER, WT %
OLEO DO PRECIPITADOR SUJO - SOLIDOS (% PESO) PRECIPITADOR OIL (DIRTY) - SOLIDS WT %
OLEO DO PRECIPITADOR LIMPO - DENSIDADE 20/4 ('C) PRECIPITADOR OIL (CLEAN) - DENSITY 20/4 °C
OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 38'C (CS) PRECIPITADOR OIL (CLEAN) - VISCOSITY 38 °C
OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 54'C (CS) PRECIPITADOR OIL (CLEAN) - VISCOSITY 54 °C
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SIX / SESIX
                                                                    R0457001
UNIDADE PILOTO   -   RESUMO DE DADOS
                                                                    PAGINA  6/7
==================================================================================
           PROPRIEDADES DOS FLUXOS  (STREANS PROPERTIES)           TESTE (TEST NUMBER)
==================================================================================
(LIGHT OIL)
OLEO LEVE - DENSIDADE 20/4 ('C)  - DENSITY 20/4ºC
OLEO LEVE - PESO MOLECULAR (KG/KGMOL) - MOLECULAR WEIGHT
OLEO LEVE - PIE - ('C)
OLEO LEVE - T10 - ('C)
OLEO LEVE - T30 - ('C)
OLEO LEVE - T50 - ('C)
OLEO LEVE - T70 - ('C)
OLEO LEVE - T90 - ('C)

(CLEAN COMPOSITE OIL)
OLEO COMPOSTO LIMPO - DENSIDADE 20/4 ('C)  -  DENSITY 20/4ºC
OLEO COMPOSTO LIMPO - VISCOSIDADE A 38'C (CS) - VISCOSITY
OLEO COMPOSTO LIMPO - VISCOSIDADE A 54'C (CS) - VISCOSITY
OLEO COMPOSTO LIMPO - CARBONO RAMSBOTTON (% PESO) - RAMSBOTTON CARBON
OLEO COMPOSTO LIMPO - CARBONO TOTAL (% PESO) -  TOTAL CARBON
OLEO COMPOSTO LIMPO - HIDROGENIO TOTAL (% PESO) - TOTAL HYDROGEN
OLEO COMPOSTO LIMPO - ENXOFRE (% PESO)  - SULFUR
OLEO COMPOSTO LIMPO - NITROGENIO (% PESO) - NITROGEN
OLEO COMPOSTO LIMPO - PODER CALORIF.SUPERIOR (KCAL/KG) - GROSS HEATING VALUE
OLEO COMPOSTO LIMPO - CINZAS (% PESO) - ASH
OLEO COMPOSTO LIMPO - PONTO DE FULGOR ('C) - FLASH POINT
OLEO COMPOSTO LIMPO - PONTO DE FLUIDEZ ('C) - POUR POINT
OLEO COMPOSTO LIMPO - PIE - ('C)
OLEO COMPOSTO LIMPO - T10 - ('C)
OLEO COMPOSTO LIMPO - T30 - ('C)
OLEO COMPOSTO LIMPO - T50 - ('C)
OLEO COMPOSTO LIMPO - T70 - ('C)
OLEO COMPOSTO LIMPO - T90 - ('C)

(RECYCLE GAS)
GAS DE RECICLO - % GAS PRODUTO UMIDO (% MOL) -  WET PRODUCT GAS
GAS DE RECICLO - % OLEO LEVE (% MOL) - LIGTH OIL
GAS DE RECICLO - % VAPOR DE AGUA (% MOL) - STEAM
GAS DE RECICLO - PESO MOLECULAR (KG/KGMOL) - MOLECULAR WEIGHT
GAS DE RECICLO - COEFICIENTE (A)
GAS DE RECICLO - COEFICIENTE (B)   SPECIFIC HEAT CONSTANTS
GAS DE RECICLO - COEFICIENTE (C)       A, B, C, AND D.
GAS DE RECICLO - COEFICIENTE (D)

(RETORTING WATER)
AGUA DE RETORTAGEM - ENXOFRE (G/L) - SULFUR
AGUA DE RETORTAGEM - NITROGENIO AMONIACAL (G/L) - AMMONIACAL NITROGEN
AGUA DE RETORTAGEM - OLEO (G/L) - OIL
AGUA DE RETORTAGEM - FENOIS (PPM) - PHENOLS
AGUA DE RETORTAGEM - PH
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                        S I X  /  S E S I X                                                  R0457001

                        UNIDADE PILOTO    -    RESUMO DE DADOS                               PAGINA  7/7
 ======================================================================================================
                                         ANALISE CROMATOGRAFICA - PERCENTAGEM MOLAR:         TESTE  (TEST NUMBER)
 ======================================================================================================
                                         CHROMATOGRAPHIC ANALYSIS  -  MOLAR %
                                                                 (AVERAGE)
                   (SAMPLE NUMBER)
                   AMOSTRA NUMERO       45G025          45G026          MEDIA

   H2O
   SO2
   H2S
   O2
   N2
   CO
   CO2
   H2
   METANO  - METHANE
   ETANO   - ETHANE
   ETENO   - ETHYLENE
   PROPANO - PROPANE
   PROPENO - PROPYLENE
   ISOBUTANO - ISOBUTANE
   N-BUTANO  - N-BUTANE
   ISOBUTENO+BUTENO1  - ISOBUTENE + BUTENE-1
   BUTENO 2T - BUTENE -2T
   BUTENO 2C - BUTENE - 2C
   ISOPENTANO  - ISOPENTANE
   C5+
   BUTADIENO+3M BUTENO1  - BUTADIENE + 3M BUTENE 1
   N-PENTANO - N-PENTANE
   PENTENO   - PENTENE
   2M BUTENO1  - 2M BUTENE 1
   PENTENO 2T  - TRANS - PENTENE 2
   PENTENO 2C  - CIS - PENTENE 2
   2M PENTANO+2M BUTENO2 - 2M PENTANE + 2M BUTENE 2
   3M PENTANO  - 3M PENTANE
   N HEXANO  - N-HEXANE
   C6+
   PESO MOLECULAR - MOLECULAR WEIGHT
   PC SUPERIOR    (KCAL/KG) - GROSS HEATING VALUE
   PC INFERIOR    (KCAL/KG) - NET HEATING VALUE
   COEFICIENTE (A)  SPECIFIC HEAT
   COEFICIENTE (B)  CONSTANTS.
   COEFICIENTE (C)  A, B, C AND D.
   COEFICIENTE (D)
 ======================================================================================================

       COEFICIENTES DA EXPRESSAO      CP=A+BT+CT2+DT3:
       CP EM (KCAL/KG)  E  TEMPERATURA EM GRAU KELVIN
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TESTE NUMERO (TEST NUMBER)                                                                              R0457002
------------------------------------------------------------------------------------------------------------------------
                                              ENERGY BALANCE  -  PILOT RETORT
                                              BALANCO DE ENERGIA - RETORTA PILOTO
------------------------------------------------------------------------------------------------------------------------
                                    KG/H                 KCAL/KG               °C                    KCAL/H
(RETORT INPUT)
ENTRANDO NA RETORTA'

XISTO CRU SECO - DRY RAW SHALE
UMIDADE  - MOISTURE
RECICLO QUENTE - HOT RECYCLE
RECICLO FRIO  - OLD RECYCLE

TOTAL

SAINDO DA RETORTA  - RETORT OUT PUT

XISTO RETORTADO - RETORT SHALE
RECICLO QUENTE  - HOT RECYCLE
RECICLO FRIO    - OLD RECYCLE
GAS PRODUTO     - PRODUCT GAS
SOLIDOS ARRASTADOS - ENTRAINED SOLIDS
OLEO DO CICLONE  - CYCLONE OIL
OLEO DO PRECIPITADOR - PRECIPITADOR OIL
OLEO LEVE VAP - VAPORIZED LIGHT OIL
AGUA DE RETORTAGEM - RETORTING WATER
DEC. CARBONATOS  -  CARBONATES DECOMPOSITION
DEC. PIRITAS - PYRITES DECOMPOSITION
R. ENDOTERMICAS - ENDOTHERMIC REACTIONS
PERDAS - HEAT LOSSES (BY DIFFERENCE)

TOTAL -(TOTAL)
------------------------------------------------------------------------------------------------------------------------
 DEMANDA TERMICA    =                   KCAL/KG XISTO UMIDO   (HEAT DEMAND)

 BASE:   ENTALPIA=0  PARA T=0 °C

 ADOTADO APPROACH DE 25 °C NA TEMPERATURA DE SAIDA DO XISTO RETORTADO  -  APPROACH GAS - SOLID TEMPERATURE ASSUMED FOR THE RETORTED SHALE
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S I X  /  S E S I X                                                        R0457001
UNIDADE PILOTO    -    RESUMO DE DADOS                                     PAGINA  1/7
==========================================================================================

NUMERO DO TESTE (NUMERO.SERIE)                               212.100
INICIO DO TESTE                                             10/12/88
INICIO DO TESTE                                                 8:45
DURACAO DO TESTE (HH.MM) (DECIMAL)                             8.000
ORIGEM DA CARGA                                  XISTO DE NEW BRUNSWICK
FAIXA GRANULOMETRICA DA CARGA                    1/4 A 3/4 POL
ALTURA DO LEITO DE PIROLISE (METROS)                           1.940
ALTURA DO LEITO DE RESFRIAMENTO (METROS)                       3.360
VELOCIDADE DE RETORTAGEM (KG/H.M2)                          2149.500
VELOCIDADE DE RETORTAGEM (LB/H.FT2)                          440.218
TEMPERATURA DE PIROLISE (TR-3/5) ('C)                        495.000
TEMPERATURA DE SAIDA DOS GASES (TR-10) ('C)                  192.000
RELACAO G/X (GAS/XISTO CRU UMIDO) (KG/KG)                      0.850
RELACAO DOS RECICLOS (RQ/RF) (KG/KG)                          13.440
PERDA DE CARGA NO LEITO DE PIROLISE (CMHG)                     3.400
RENDIMENTO EM OLEO S/ENSAIO FISCHER (% PESO)                  94.600
RENDIMENTO EM GAS S/ENSAIO FISCHER (% PESO)                  125.900
RENDIMENTO EM OLEO+GAS S/ENSAIO FISCHER (% PESO)             102.000
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S I X  /  S E S I X                                                              R0457001

UNIDADE PILOTO    -    RESUMO DE DADOS                                           PAGINA  2/7
==========================================================================================================
BALANCO DE MATERIAL                                                              TESTE  212.1
==========================================================================================================

ENTRA:           - XISTO CRU UMIDO (KG/H)                                  69.370
                 - VAPOR DO PRECIPITADOR (KG/H)                            10.000
                 - TOTAL ENTRANDO (KG/H)                                   79.370

SAI:             - OLEO COMPOSTO LIMPO (KG/H)                               3.960
                 - GAS PRODUTO UMIDO (KG/H)                                 1.620
                 - AGUA (KG/H)                                             10.330
                 - SOLIDOS ARRASTADOS (KG/H)                                0.270
                 - XISTO RETORTADO (BAL. RETORTA)   (KG/H)                 63.400
                 - TOTAL SAINDO (KG/H)                                     79.580
FECHAMENTO DO BALANCO MATERIAL (SAINDO/ENTRANDO) (%)                      100.250


==========================================================================================================
BALANCO DE AGUA
==========================================================================================================

ENTRA:       - AGUA DE UMIDADE (KG/H)                                       0.740
             - AGUA DE PIROLISE (KG/H)                                      0.640
             - VAPOR DO PRECIPITADOR (KG/H)                                10.000
             - TOTAL ENTRANDO (KG/H)                                       11.370

SAI:         - AGUA NO OLEO DO CICLONE (KG/H)                               0.610
             - AGUA NO OLEO DO PRECIPITADOR (KG/H)                          9.680
             - AGUA NO CONDENSADOR (KG/H)                                   0.030
             - AGUA NO GAS PRODUTO (KG/H)                                   0.290
             - TOTAL SAINDO (KG/H)                                         10.610
FECHAMENTO DO BALANCO DE AGUA (SAINDO/ENTRANDO) (%)                        93.300
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S I X  /  S E S I X                                                          R0457001
UNIDADE PILOTO    -    RESUMO DE DADOS                                       PAGINA  3/7
==========================================================================================
         BALANCO DE CARBONO                                                  TESTE  212.1
==========================================================================================

         ENTRA:       - CARBONO NO XISTO CRU SECO (KG/H)              [illegible]30

         SAI:         - CARBONO NO XISTO RETORTADO (KG/H)                    3.530
                      - CARBONO NO OLEO COMPOSTO (KG/H)                      3.370
                      - CARBONO NO GAS PRODUTO (KG/H)                        0.603
                      - TOTAL SAINDO (KG/H)                                  7.507
         FECHAMENTO DO BALANCO DE CARBONO (SAINDO/ENTRANDO) (%)            101.740

==========================================================================================
         BALANCO DE HIDROGENIO
==========================================================================================

         ENTRA:         - HIDROGENIO NO XISTO CRU SECO (KG/H)                0.940

         SAI:           - HIDROGENIO NO XISTO RETORTADO (KG/H)               0.340
                        - HIDROGENIO NO OLEO COMPOSTO (KG/H)                 0.467
                        - HIDROGENIO NO GAS PRODUTO SECO (KG/H)              0.128
                        - NA AGUA DE PIROLISE LIBERADA (KG/H)                0.039
                        - TOTAL SAINDO (KG/H)                                0.970
         FECHAMENTO DO BALANCO DE HIDROGENIO (SAINDO/ENT.) (%)             103.150

==========================================================================================
         BALANCO DE ENXOFRE
==========================================================================================

         ENTRA:       - ENXOFRE NO XISTO CRU SECO (KG/H)                     0.618

         SAI:         - ENXOFRE NO XISTO RETORTADO (KG/H)                    0.418
                      - ENXOFRE NO OLEO COMPOSTO (KG/H)                      0.037
                      - ENXOFRE NO GAS PRODUTO (KG/H)                        0.051
                      - ENXOFRE NA AGUA DE RETORTAGEM (KG/H)                 0.020
                      - TOTAL SAINDO (KG/H)                                  0.527
         FECHAMENTO DO BALANCO DE ENXOFRE (SAINDO/ENTRANDO) (%)             85.240
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S I X  /  S E S I X
                                                                        R045700:
UNIDADE PILOTO        FLUXO DE DADOS
                                                                        PAGINA  1/7
================================================================================
      TEMPERATURAS
================================================================================
                                                                        TESTE  212.1
================================================================================

      TEMPERATURA DO RF NA ENTRADA DA RETORTA (TR-17) ('C)             116.000
      TEMPERATURA DO RG NA ENTRADA DA RETORTA (TR-25/27) ('C)          505.000
      TEMPERATURA DO XISTO RETORTADO (TR-08) ('C)                      312.000
      TEMPERATURA DO TOPO DO LEITO (TR-01) ('C)                        346.000
      TEMPERATURA DO GAS PRODUTO UMIDO (TR-19) ('C)                     26.000

================================================================================
      PRESSOES
================================================================================

      PRESSAO NO FUNDO DA RETORTA (PR-07) (CMHG)                         3.760
      PRESSAO NO MEIO DO LEITO DE RESFRIAMENTO (PR-06) (CMHG)            3.570
      PRESSAO NO LEITO DE PIROLISE INJETOR INF (PR-05) (CMHG)            3.770
      PRESSAO NO LEITO DE PIROLISE INJETOR INT (PR-04) (CMHG)          999.500
      PRESSAO NO LEITO DE PIROLISE INJETOR SUP (PR-03) (CMHG)            3.630
      PRESSAO NO LEITO DE PIROLISE NIVEL MEDIO (PR-02) (CMHG)            1.890
      PRESSAO NO TOPO DO LEITO (PR-01) (CMHG)                            0.200
      PRESSAO NA SAIDA DOS GASES DA RETORTA (PRC-08) (CMHG)              0.220
      PRESSAO NA SUCCAO DO COMPRESSOR (PRC-09) (CMHG)                   -0.220

================================================================================
      VAZOES
================================================================================

      VAZAO DE XISTO CRU UMIDO (KG/H)                                   69.370
      VAZAO DE XISTO CRU SECO (KG/H)                                    68.640
      VAZAO DE OLEO DO CICLONE (SUJO) (KG/H)                             0.890
      VAZAO DE OLEO DO CICLONE (LIMPO) (KG/H)                            0.390
      VAZAO DE OLEO DO PRECIPITADOR (SUJO) (KG/H)                        3.390
      VAZAO DE OLEO DO PRECIPITADOR (LIMPO) (KG/H)                       3.010
      VAZAO DE OLEO LEVE (KG/H)                                          0.560
      VAZAO DE AGUA DE RETORTAGEM (TOTAL) (KG/H)                        10.330
      VAZAO DE GAS PRODUTO UMIDO (KG/H)                                  1.650
      VAZAO DE GAS DE RECICLO QUENTE (KG/H)                             54.800
      VAZAO DE GAS DE RECICLO FRIO (KG/H)                                4.080
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SIX / SESIA
                                                                        R0457001
UNIDADE PILOTO   -   RESUMO DE DADOS
                                                                        PAGINA  5/7
==========================================================================================
PROPRIEDADES DOS FLUXOS                                                 TESTE  212.1
==========================================================================================

GRANULOMETRIA DA CARGA (- 1   + 3/4)                                     0.000
GRANULOMETRIA DA CARGA (- 3/4 + 1/2)                                    65.000
GRANULOMETRIA DA CARGA (- 1/2 + 1/4)                                    35.000

XISTO CRU - UMIDADE (% PESO)                                             1.060
XISTO CRU - ENSAIO FISCHER - OLEO (% PESO)                               6.100
XISTO CRU - ENSAIO FISCHER - AGUA (% PESO)                               0.930
XISTO CRU - ENSAIO FISCHER - GAS+PERDAS (% PESO)                         1.880
XISTO CRU - ENSAIO FISCHER - RESIDUO (% PESO)                           91.090
XISTO CRU - PERDA AO FOGO (% PESO)                                      21.110
XISTO CRU - CARBONO TOTAL (% PESO)                                      10.750
XISTO CRU - CARBONO MINERAL (% PESO)                                     2.980
XISTO CRU - HIDROGENIO TOTAL (% PESO)                                    1.370
XISTO CRU - ENXOFRE (% PESO)                                             0.900
XISTO CRU - PODER CALORIFICO SUPERIOR (KCAL/KG)                        899.000

XISTO RETORTADO - ENSAIO FISCHER - OLEO (% PESO)                         0.000
XISTO RETORTADO - ENSAIO FISCHER - AGUA (% PESO)                         0.450
XISTO RETORTADO - ENSAIO FISCHER - GAS+PERDAS (% PESO)                   0.060
XISTO RETORTADO - ENSAIO FISCHER - RESIDUO (% PESO)                     99.490
XISTO RETORTADO - PERDA AO FOGO (% PESO)                                14.590
XISTO RETORTADO - CARBONO TOTAL (% PESO)                                 5.570
XISTO RETORTADO - CARBONO MINERAL (% PESO)                               2.760
XISTO RETORTADO - HIDROGENIO TOTAL (% PESO)                              0.530
XISTO RETORTADO - ENXOFRE (% PESO)                                       0.700
XISTO RETORTADO - PODER CALORIFICO SUPERIOR (KCAL/KG)                  269.000

OLEO DO CICLONE SUJO - AGUA (% PESO)                                    26.690
OLEO DO CICLONE SUJO - SOLIDOS (% PESO)                                 29.260
OLEO DO CICLONE LIMPO - DENSIDADE 20/4 ('C)                              0.979
OLEO DO CICLONE LIMPO - VISCOSIDADE A 54.4'C (CS)                      321.600
OLEO DO CICLONE LIMPO - VISCOSIDADE A 98.9'C (CS)                       28.300
OLEO DO PRECIPITADOR SUJO - AGUA (% PESO)                               11.040
OLEO DO PRECIPITADOR SUJO - SOLIDOS (% PESO)                             0.180
OLEO DO PRECIPITADOR LIMPO - DENSIDADE 20/4 ('C)                         0.949
OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 38'C (CS)                   124.730
OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 54'C (CS)                    49.430
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S I X  /  S E S I X                                                         R0457001

UNIDADE PILOTO   -   RESUMO DE DADOS                                        PAGINA  6/7
==========================================================================================
PROPRIEDADES DOS FLUXOS                                                     TESTE  212.1
==========================================================================================

OLEO LEVE - DENSIDADE 20/4 ('C)                                          0.810
OLEO LEVE - PESO MOLECULAR (KG/KGMOL)                                  138.930
OLEO LEVE - PIE - ('C)                                                  80.000
OLEO LEVE - T10 - ('C)                                                 130.000
OLEO LEVE - T30 - ('C)                                                 159.000
OLEO LEVE - T50 - ('C)                                                 188.000
OLEO LEVE - T70 - ('C)                                                 220.000
OLEO LEVE - T90 - ('C)                                                 266.000

OLEO COMPOSTO LIMPO - DENSIDADE 20/4 ('C)                                0.931
OLEO COMPOSTO LIMPO - VISCOSIDADE A 38'C (CS)                           41.850
OLEO COMPOSTO LIMPO - VISCOSIDADE A 54'C (CS)                           22.450
OLEO COMPOSTO LIMPO - CARBONO RAMSBOTTON (% PESO)                        3.350
OLEO COMPOSTO LIMPO - CARBONO TOTAL (% PESO)                            85.160
OLEO COMPOSTO LIMPO - HIDROGENIO TOTAL (% PESO)                         11.780
OLEO COMPOSTO LIMPO - ENXOFRE (% PESO)                                   0.930
OLEO COMPOSTO LIMPO - NITROGENIO (% PESO)                                1.190
OLEO COMPOSTO LIMPO - PODER CALORIF.SUPERIOR (KCAL/KG)               10162.000
OLEO COMPOSTO LIMPO - CINZAS (% PESO)                                    0.340
OLEO COMPOSTO LIMPO - PONTO DE FULGOR ('C)                              32.000
OLEO COMPOSTO LIMPO - PONTO DE FLUIDEZ ('C)                              0.000
OLEO COMPOSTO LIMPO - PIE - ('C)                                        48.000
OLEO COMPOSTO LIMPO - T10 - ('C)                                       204.000
OLEO COMPOSTO LIMPO - T30 - ('C)                                       348.000
OLEO COMPOSTO LIMPO - T50 - ('C)                                       424.000
OLEO COMPOSTO LIMPO - T70 - ('C)                                       492.000
OLEO COMPOSTO LIMPO - T90 - ('C)                                       524.000

GAS DE RECICLO - % GAS PRODUTO UMIDO (% MOL)                            11.140
GAS DE RECICLO - % OLEO LEVE (% MOL)                                     0.660
GAS DE RECICLO - % VAPOR DE AGUA (% MOL)                                88.200
GAS DE RECICLO - PESO MOLECULAR (KG/KGMOL)                              19.537
GAS DE RECICLO - COEFICIENTE (A)                                  0.371691E+00
GAS DE RECICLO - COEFICIENTE (B)                                  -.285821E-04
GAS DE RECICLO - COEFICIENTE (C)                                  0.458376E-06
GAS DE RECICLO - COEFICIENTE (D)                                  -.275815E-09

AGUA DE RETORTAGEM - ENXOFRE (G/L)                                       1.920
AGUA DE RETORTAGEM - NITROGENIO AMONIACAL (G/L)                          5.210
AGUA DE RETORTAGEM - OLEO (G/L)                                          0.160
AGUA DE RETORTAGEM - FENOIS (PPM)                                      125.000
AGUA DE RETORTAGEM - PH                                                  8.600
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                  S I X  /  S E S I X                                                   R0457001

                  UNIDADE PILOTO   -   RESUMO DE DADOS                                  PAGINA  7/7
==========================================================================================================
                                    ANALISE CROMATOGRAFICA - PERCENTAGEM MOLAR:         TESTE  212.1
==========================================================================================================

              AMOSTRA NUMERO       45G57           45G58           MEDIA

 H20                                2.828           2.828           2.828
 S02                                0.000           0.000           0.000
 H2S                                2.416           2.318           2.367
 02                                 0.280           0.215           0.248
 N2                                10.757           8.281           9.519
 CO                                 0.556           0.638           0.597
 CO2                               29.810          30.034          29.922
 H2                                31.685          33.794          32.739
 METANO                            11.164          11.457          11.310
 ETANO                              3.123           3.170           3.147
 ETENO                              1.091           1.096           1.093
 PROPANO                            1.529           1.537           1.533
 PROPENO                            1.449           1.456           1.452
 ISOBUTANO                          0.169           0.170           0.169
 N-BUTANO                           0.624           0.613           0.618
 ISOBUTENO+BUTENO1                  0.809           0.807           0.808
 BUTENO 2T                          0.229           0.216           0.222
 BUTENO 2C                          0.295           0.289           0.292
 ISOPENTANO                         0.124           0.167           0.146
 C5+                                1.059           0.915           0.988
 BUTADIENO+3M BUTENO1               0.000           0.000           0.000
 N-PENTANO                          0.000           0.000           0.000
 PENTENO                            0.000           0.000           0.000
 2M BUTENO1                         0.000           0.000           0.000
 PENTENO 2T                         0.000           0.000           0.000
 PENTENO 2C                         0.000           0.000           0.000
 2M PENTANO+2M BUTENO2              0.000           0.000           0.000
 3M PENTANO                         0.000           0.000           0.000
 N HEXANO                           0.000           0.000           0.000
 C6+                                0.000           0.000           0.000
 PESO MOLECULAR                    24.765          24.154          24.459
 PC SUPERIOR   (KCAL/KG)         4196.756        4350.771        4273.764
 PC INFERIOR   (KCAL/KG)         3795.106        3929.841        3862.474
 COEFICIENTE (A)             0.216979E+00    0.222523E+00    0.219751E+00
 COEFICIENTE (B)             0.530221E-03    0.541232E-03    0.535726E-03
 COEFICIENTE (C)            -0.208439E-06   -0.216550E-06   -0.212495E-06
 COEFICIENTE (D)             0.241438E-10    0.270586E-10    0.256012E-10

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     COEFICIENTES DA EXPRESSAO     CP=A+BT+CT2+DT3:
     CP EM (KCAL/KG)  E  TEMPERATURA EM GRAU KELVIN
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TESTE NUMERO  212.1
                                                                          R0457002
==========================================================================================
                         BALANCO DE ENERGIA - RETORTA PILOTO
==========================================================================================
==========================================================================================
                              KG/H            KCAL/KG           "C              KCAL/H
ENTRANDO NA RETORTA

XISTO CRU SECO              68.640             6.1750           25.            423.850
UMIDADE                      0.735            25.0000           25.             18.385
RECICLO QUENTE              54.800           224.0978          505.          12280.603
RECICLO FRIO                 4.076            46.7112          116.            190.395

TOTAL                      128.251                                           12913.231

SAINDO DA RETORTA

XISTO RETORTADO             63.400            80.9911          337.           5134.820
RECICLO QUENTE              54.800            78.7581          192.           4315.961
RECICLO FRIO                 4.076            78.7581          192.            321.018
GAS PRODUTO                  1.659            74.7416          192.            124.026
SOLIDOS ARRASTADOS           0.265            48.5536          192.             12.886
OLEO DO CICLONE              0.390            96.0000          192.             37.478
OLEO DO PRECIPITADOR         3.007            96.0000          192.            288.710
OLEO LEVE VAP                0.562           162.3812          192.             91.339
AGUA DE RETORTAGEM           1.088           680.6349          192.            740.803
DEC. CARBONATOS                                                                902.036
DEC. PIRITAS                                                                    18.002
R. ENDOTERMICAS                                                                157.871
PERDAS                                                                         768.280

TOTAL                      129.249                                           12913.231
==========================================================================================
DEMANDA TERMICA   =    101.85     KCAL/KG XISTO UMIDO

BASE:   ENTALPIA=0   PARA T=0 "C

ADOTADO APPROACH DE 25 "C NA TEMPERATURA DE SAIDA DO XISTO RETORTADO
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S I X  /  S E S I X                                                          R0457001
UNIDADE PILOTO    -    RESUMO DE DADOS                                       PAGINA  1/7
======================================================================================================

NUMERO DO TESTE (NUMERO.SERIE)                            212.200
INICIO DO TESTE                                           10/12/88
INICIO DO TESTE                                              16:45
DURACAO DO TESTE (HH.MM) (DECIMAL)                           6.000
ORIGEM DA CARGA                                        XISTO DE NEW BRUNSWICK
FAIXA GRANULOMETRICA DA CARGA                          1/4 A 3/4 POL
ALTURA DO LEITO DE PIROLISE (METROS)                         1.940
ALTURA DO LEITO DE RESFRIAMENTO (METROS)                     3.360
VELOCIDADE DE RETORTAGEM (KG/H.M2)                        2587.100
VELOCIDADE DE RETORTAGEM (LB/H.FT2)                        529.838
TEMPERATURA DE PIROLISE (TR-3/5) ('C)                      504.000
TEMPERATURA DE SAIDA DOS GASES (TR-10) ('C)                197.000
RELACAO G/X (GAS/XISTO CRU UMIDO) (KG/KG)                    0.800
RELACAO DOS RECICLOS (RQ/RF) (KG/KG)                        14.660
PERDA DE CARGA NO LEITO DE PIROLISE (CMHG)                   4.500
RENDIMENTO EM OLEO S/ENSAIO FISCHER (% PESO)                98.000
RENDIMENTO EM GAS S/ENSAIO FISCHER (% PESO)                127.600
RENDIMENTO EM OLEO+GAS S/ENSAIO FISCHER (% PESO)           105.000
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   S I X  /  S E S I X
                                                                      R0457001
   UNIDADE PILOTO    -    RESUMO DE DADOS
                                                                      PAGINA  2/7
================================================================================
   BALANCO DE MATERIAL
================================================================================
                                                                      TESTE  212.2
================================================================================

   ENTRA:         - XISTO CRU UMIDO (KG/H)                      83.500
                  - VAPOR DO PRECIPITADOR (KG/H)                10.000
                  - TOTAL ENTRANDO (KG/H)                       93.500

   SAI:           - OLEO COMPOSTO LIMPO (KG/H)                   4.940
                  - GAS PRODUTO UMIDO (KG/H)                     1.980
                  - AGUA (KG/H)                                 11.460
                  - SOLIDOS ARRASTADOS (KG/H)                    0.540
                  - XISTO RETORTADO (BAL. RETORTA)  (KG/H)      74.910
                  - TOTAL SAINDO (KG/H)                         93.820
   FECHAMENTO DO BALANCO MATERIAL (SAINDO/ENTRANDO) (%)        100.350


================================================================================
   BALANCO DE AGUA
================================================================================
================================================================================

   ENTRA:      - AGUA DE UMIDADE (KG/H)                          0.890
               - AGUA DE PIROLISE (KG/H)                         0.770
               - VAPOR DO PRECIPITADOR (KG/H)                   10.000
               - TOTAL ENTRANDO (KG/H)                          11.650

   SAI:        - AGUA NO OLEO DO CICLONE (KG/H)                  0.540
               - AGUA NO OLEO DO PRECIPITADOR (KG/H)            10.870
               - AGUA NO CONDENSADOR (KG/H)                      0.050
               - AGUA NO GAS PRODUTO (KG/H)                      0.290
               - TOTAL SAINDO (KG/H)                            11.750
   FECHAMENTO DO BALANCO DE AGUA (SAINDO/ENTRANDO) (%)         100.870
   S.I X / S E S I X                                                                    9045700
   UNIDADE PILOTO   -   RESUMO DE DADOS                                                 PAGINA  3/7
==================================================================================================
     BALANCO DE CARBONO
                                                                                         TESTE  212.2
==================================================================================================

   ENTRA:          - CARBONO NO XISTO CRU SECO (KG/H)                      8.880

   SAI:            - CARBONO NO XISTO RETORTADO (KG/H)                     4.070
                   - CARBONO NO OLEO COMPOSTO (KG/H)                       4.200
                   - CARBONO NO GAS PRODUTO (KG/H)                         0.780
                   - TOTAL SAINDO (KG/H)                                   9.049
   FECHAMENTO DO BALANCO DE CARBONO (SAINDO/ENTRANDO) (%)                101.890
==================================================================================================
     BALANCO DE HIDROGENIO
==================================================================================================

   ENTRA:             - HIDROGENIO NO XISTO CRU SECO (KG/H)                1.130

   SAI:               - HIDROGENIO NO XISTO RETORTADO (KG/H)               0.370
                      - HIDROGENIO NO OLEO COMPOSTO (KG/H)                 0.585
                      - HIDROGENIO NO GAS PRODUTO SECO (KG/H)              0.170
                      - NA AGUA DE PIROLISE LIBERADA (KG/H)                0.053
                      - TOTAL SAINDO (KG/H)                                1.174
   FECHAMENTO DO BALANCO DE HIDROGENIO (SAINDO/ENT.) (%)                 103.740
==================================================================================================
     BALANCO DE ENXOFRE
==================================================================================================

   ENTRA:          - ENXOFRE NO XISTO CRU SECO (KG/H)                      0.744

   SAI:            - ENXOFRE NO XISTO RETORTADO (KG/H)                     0.532
                   - ENXOFRE NO OLEO COMPOSTO (KG/H)                       0.031
                   - ENXOFRE NO GAS PRODUTO (KG/H)                         0.062
                   - ENXOFRE NA AGUA DE RETORTAGEM (KG/H)                  0.025
                   - TOTAL SAINDO (KG/H)                                   0.650
   FECHAMENTO DO BALANCO DE ENXOFRE (SAINDO/ENTRANDO) (%)                 87.420
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SIX / SEBIX                                                                        R0457901
UNIDADE PILOTO   -   RESUMO DE DADOS                                               PAGINA  4/7
==================================================================================================
     TEMPERATURAS                                                                  TESTE  212.2
==================================================================================================

    TEMPERATURA DO RF NA ENTRADA DA RETORTA (TR-17) ('C)                  137.000
    TEMPERATURA DO RQ NA ENTRADA DA RETORTA (TR-25/27) ('C)               516.000
    TEMPERATURA DO XISTO RETORTADO (TR-08) ('C)                           419.000
    TEMPERATURA DO TOPO DO LEITO (TR-01) ('C)                             346.000
    TEMPERATURA DO GAS PRODUTO UMIDO (TR-19) ('C)                          30.000

==================================================================================================
     PRESSOES
==================================================================================================

    PRESSAO NO FUNDO DA RETORTA (PR-07) (CMHG)                              4.970
    PRESSAO NO MEIO DO LEITO DE RESFRIAMENTO (PR-06) (CMHG)                 4.680
    PRESSAO NO LEITO DE PIROLISE INJETOR INF (PR-05) (CMHG)                 4.910
    PRESSAO NO LEITO DE PIROLISE INJETOR INT (PR-04) (CMHG)               999.500
    PRESSAO NO LEITO DE PIROLISE INJETOR SUP (PR-03) (CMHG)                 4.700
    PRESSAO NO LEITO DE PIROLISE NIVEL MEDIO (PR-02) (CMHG)                 2.440
    PRESSAO NO TOPO DO LEITO (PR-01) (CMHG)                                 0.210
    PRESSAO NA SAIDA DOS GASES DA RETORTA (PRC-08) (CMHG)                   0.220
    PRESSAO NA SUCCAO DO COMPRESSOR (PRC-09) (CMHG)                        -0.900

==================================================================================================
     VAZOES
==================================================================================================

    VAZAO DE XISTO CRU UMIDO (KG/H)                                        83.500
    VAZAO DE XISTO CRU SECO (KG/H)                                         82.610
    VAZAO DE OLEO DO CICLONE (SUJO) (KG/H)                                  1.810
    VAZAO DE OLEO DO CICLONE (LIMPO) (KG/H)                                 0.900
    VAZAO DE OLEO DO PRECIPITADOR (SUJO) (KG/H)                             3.420
    VAZAO DE OLEO DO PRECIPITADOR (LIMPO) (KG/H)                            3.250
    VAZAO DE OLEO LEVE (KG/H)                                               0.780
    VAZAO DE AGUA DE RETORTAGEM (TOTAL) (KG/H)                             11.460
    VAZAO DE GAS PRODUTO UMIDO (KG/H)                                       2.030
    VAZAO DE GAS DE RECICLO QUENTE (KG/H)                                  62.550
    VAZAO DE GAS DE RECICLO FRIO (KG/H)                                     4.270
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S.I X  /  S E S I X                                                                R01/001

UNIDADE PILOTO   -   RESUMO DE DADOS                                               PAGINA  5/7
==================================================================================================
       PROPRIEDADES DOS FLUXOS                                                     TESTE  212.2
==================================================================================================

   GRANULOMETRIA DA CARGA (- 1   + 3/4)                                  0.000
   GRANULOMETRIA DA CARGA (- 3/4 + 1/2)                                 65.000
   GRANULOMETRIA DA CARGA (- 1/2 + 1/4)                                 35.000

   XISTO CRU - UMIDADE (% PESO)                                          1.060
   XISTO CRU - ENSAIO FISCHER - OLEO (% PESO)                            6.100
   XISTO CRU - ENSAIO FISCHER - AGUA (% PESO)                            0.930
   XISTO CRU - ENSAIO FISCHER - GAS+PERDAS (% PESO)                      1.880
   XISTO CRU - ENSAIO FISCHER - RESIDUO (% PESO)                        91.090
   XISTO CRU - PERDA AO FOGO (% PESO)                                   21.110
   XISTO CRU - CARBONO TOTAL (% PESO)                                   10.750
   XISTO CRU - CARBONO MINERAL (% PESO)                                  2.980
   XISTO CRU - HIDROGENIO TOTAL (% PESO)                                 1.370
   XISTO CRU - ENXOFRE (% PESO)                                          0.900
   XISTO CRU - PODER CALORIFICO SUPERIOR (KCAL/KG)                     899.000

   XISTO RETORTADO - ENSAIO FISCHER - OLEO (% PESO)                      0.000
   XISTO RETORTADO - ENSAIO FISCHER - AGUA (% PES))                      0.390
   XISTO RETORTADO - ENSAIO FISCHER - GAS+PERDAS (% PESO)                0.060
   XISTO RETORTADO - ENSAIO FISCHER - RESIDUO (% PESO)                  99.550
   XISTO RETORTADO - PERDA AO FOGO (% PESO)                             12.990
   XISTO RETORTADO - CARBONO TOTAL (% PESO)                              5.430
   XISTO RETORTADO - CARBONO MINERAL (% PESO)                            2.350
   XISTO RETORTADO - HIDROGENIO TOTAL (% PESO)                           0.490
   XISTO RETORTADO - ENXOFRE (% PESO)                                    0.700
   XISTO RETORTADO - PODER CALORIFICO SUPERIOR (KCAL/KG)               292.000

   OLEO DO CICLONE SUJO - AGUA (% PESO)                                 20.760
   OLEO DO CICLONE SUJO - SOLIDOS (% PESO)                              29.510
   OLEO DO CICLONE LIMPO - DENSIDADE 20/4 ('C)                           0.974
   OLEO DO CICLONE LIMPO - VISCOSIDADE A 54.4'C (CS)                   205.600
   OLEO DO CICLONE LIMPO - VISCOSIDADE A 98.9'C (CS)                    21.800
   OLEO DO PRECIPITADOR SUJO - AGUA (% PESO)                             4.730
   OLEO DO PRECIPITADOR SUJO - SOLIDOS (% PESO)                          0.050
   OLEO DO PRECIPITADOR LIMPO - DENSIDADE 20/4 ('C)                      0.945
   OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 38'C (CS)                 93.220
   OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 54'C (CS)                 34.460
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        P I X  /  F E S I X
                                                                                    R045700)
        UNIDADE PILOTO    -    RESUMO DE DADOS
                                                                                    PAGINA  6/7
=============================================================================================
        PROPRIEDADES DOS FLUXOS
=============================================================================================
                                                                                    TESTE  212.2
=============================================================================================

     OLEO LEVE - DENSIDADE 20/4 ('C)
     OLEO LEVE - PESO MOLECULAR (KG/KGMOL)                                 0.813
     OLEO LEVE - PIE - ('C)                                              141.550
     OLEO LEVE - T10 - ('C)                                               82.000
     OLEO LEVE - T30 - ('C)                                              131.000
     OLEO LEVE - T50 - ('C)                                              162.000
     OLEO LEVE - T70 - ('C)                                              192.000
     OLEO LEVE - T90 - ('C)                                              226.000
                                                                         276.000

     OLEO COMPOSTO LIMPO - DENSIDADE 20/4 ('C)
     OLEO COMPOSTO LIMPO - VISCOSIDADE A 38'C (CS)                         0.731
     OLEO COMPOSTO LIMPO - VISCOSIDADE A 54'C (CS)                        41.150
     OLEO COMPOSTO LIMPO - CARBONO RAMSBOTTON (% PESO)                    19.560
     OLEO COMPOSTO LIMPO - CARBONO TOTAL (% PESO)                          3.250
     OLEO COMPOSTO LIMPO - HIDROGENIO TOTAL (% PESO)                      85.100
     OLEO COMPOSTO LIMPO - ENXOFRE (% PESO)                               11.040
     OLEO COMPOSTO LIMPO - NITROGENIO (% PESO)                             0.620
     OLEO COMPOSTO LIMPO - PODER CALORIF.SUPERIOR (KCAL/KG)                1.120
     OLEO COMPOSTO LIMPO - CINZAS (% PESO)                             10250.000
     OLEO COMPOSTO LIMPO - PONTO DE FULGOR ('C)                            0.340
     OLEO COMPOSTO LIMPO - PONTO DE FLUIDEZ ('C)                          48.000
     OLEO COMPOSTO LIMPO - PIE - ('C)                                      0.000
     OLEO COMPOSTO LIMPO - T10 - ('C)                                     73.000
     OLEO COMPOSTO LIMPO - T30 - ('C)                                    203.000
     OLEO COMPOSTO LIMPO - T50 - ('C)                                    343.000
     OLEO COMPOSTO LIMPO - T70 - ('C)                                    419.000
     OLEO COMPOSTO LIMPO - T90 - ('C)                                    483.000
                                                                         528.000

     GAS DE RECICLO - % GAS PRODUTO UMIDO (% MOL)
     GAS DE RECICLO - % OLEO LEVE (% MOL)                                 12.300
     GAS DE RECICLO - % VAPOR DE AGUA (% MOL)                              0.800
     GAS DE RECICLO - PESO MOLECULAR (KG/KGMOL)                           86,910
     GAS DE RECICLO - COEFICIENTE (A)                                     19.717
     GAS DE RECICLO - COEFICIENTE (B)                                0.361773E+00
     GAS DE RECICLO - COEFICIENTE (C)                                -.364770E-05
     GAS DE RECICLO - COEFICIENTE (D)                                0.436952E-06
                                                                     -.268418E-09

     AGUA DE RETORTAGEM - ENXOFRE (G/L)
     AGUA DE RETORTAGEM - NITROGENIO AMONIACAL (G/L)                       2.210
     AGUA DE RETORTAGEM - OLEO (G/L)                                       5.980
     AGUA DE RETORTAGEM - FENOIS (PPM)                                     0.140
     AGUA DE RETORTAGEM - PH                                             175.000
                                                                           8.750
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                S I X  /  S E S I X                                                    R0457001

                UNIDADE PILOTO   -   RESUMO DE DADOS                                   PAGINA  7/7
=====================================================================================================
                                  ANALISE CROMATOGRAFICA - PERCENTAGEM MOLAR:          TESTE '212.2
=====================================================================================================

            AMOSTRA NUMERO          45G59           45G60           MEDIA

   H20                              3.454           3.454           3.454
   S02                              0.000           0.000           0.000
   H2S                              2.712           1.832           2.272
   02                               0.677           0.198           0.437
   N2                               8.775           5.177           6.976
   CO                               0.853           0.656           0.755
   C02                             26.955          30.334          28.645
   H2                              35.362          34.689          35.025
   METANO                          10.720          11.998          11.359
   ETANO                            2.931           3.294           3.112
   ETENO                            1.123           1.216           1.169
   PROPANO                          1.393           1.576           1.484
   PROPENO                          1.420           1.572           1.496
   ISOBUTANO                        0.157           0.177           0.167
   N-BUTANO                         0.584           0.658           0.621
   ISOBUTENO+BUTENO1                0.822           0.908           0.865
   BUTENO 2T                        0.237           0.255           0.246
   BUTENO 2C                        0.316           0.339           0.327
   ISOPENTANO                       0.122           0.149           0.135
   C5+                              1.388           1.518           1.452
   BUTADIENO+3M BUTENO1             0.000           0.000           0.000
   N-PENTANO                        0.000           0.000           0.000
   PENTENO                          0.000           0.000           0.000
   2M BUTENO1                       0.000           0.000           0.000
   PENTENO 2T                       0.000           0.000           0.000
   PENTENO 2C                       0.000           0.000           0.000
   2M PENTANO+2M BUTENO2            0.000           0.000           0.000
   3M PENTANO                       0.000           0.000           0.000
   N HEXANO                         0.000           0.000           0.000
   C6+                              0.000           0.000           0.000
   PESO MOLECULAR                  23.496          24.182          23.839
   PC SUPERIOR    (KCAL/KG)      4569.565        4736.068        4652.816
   PC INFERIOR    (KCAL/KG)      4129.601        4285.288        4207.444
   COEFICIENTE (A)             0.231402E+00    0.218843E+00    0.225122E+00
   COEFICIENTE (B)             0.550508E-03    0.595139E-03    0.572823E-03
   COEFICIENTE (C)            -0.214032E-06   -0.243481E-06   -0.228757E-06
   COEFICIENTE (D)             0.249006E-10    0.337099E-10    0.293052E-10
=====================================================================================================

      COEFICIENTES DA EXPRESSAO     CP=A+BT+CT2+DT3:
      CP EM (KCAL/KG)  E  TEMPERATURA EM GRAU KELVIN
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TESTE NUMERO  212.2
                                                                                 R0457002
==========================================================================================
                              BALANCO DE ENERGIA - RETORTA PILOTO
==========================================================================================
==========================================================================================
                           KG/H            KCAL/KG            "C               KCAL/H
ENTRANDO NA RETORTA

XISTO CRU SECO            82.615            6.1750            25.              510.147
UMIDADE                    0.885           25.0000            25.               22.128
RECICLO QUENTE            62.545          228.6353           516.            14300.063
RECICLO. FRIO              4.266           54.9478           137.              234.391

TOTAL                    150.311                                             15066.729

SAINDO DA RETORTA

XISTO RETORTADO           74.905          110.3548           444.             8266.141
RECICLO QUENTE            62.545           80.2651           197.             5020.206
RECICLO FRIO               4.266           80.2651           197.              342.387
GAS PRODUTO                2.036           80.2352           197.              163.335
SOLIDOS ARRASTADOS         0.536           50.1137           197.               26.876
OLEO DO CICLONE            0.901           98.5000           197.               88.739
OLEO DO PRECIPITADOR       3.253           98.5000           197.              320.460
OLEO LEVE VAP              0.783          164.6256           197.              128.951
AGUA DE RETORTAGEM         1.361          682.9219           197.              929.642
DEC. CARBONATOS                                                               1955.966
DEC. PIRITAS                                                                    21.749
R. ENDOTERMICAS                                                                190.014
PERDAS                                                                       -2387.756

TOTAL                    150.587                                             15066.729
==========================================================================================

DEMANDA TERMICA   =   138.44     KCAL/KG XISTO UMIDO

BASE:   ENTALPIA=0  PARA T=0 "C

ADOTADO APPROACH DE 25 "C NA TEMPERATURA DE SAIDA DO XISTO RETORTADO
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   S I X  /  S E S I X                                                       R0457001
   UNIDADE PILOTO   -   RESUMO DE DADOS                                    PAGINA  1/7
==========================================================================================

   NUMERO DO TESTE (NUMERO.SERIE)                            213.100
   INICIO DO TESTE                                          13/12/88
   INICIO DO TESTE                                             10:45
   DURACAO DO TESTE (HH.MM) (DECIMAL)                          6.000
   ORIGEM DA CARGA                                      XISTO DE NEW BRUNSWICK
   FAIXA GRANULOMETRICA DA CARGA                        1/4 A 3/4 POL
   ALTURA DO LEITO DE PIROLISE (METROS)                        1.940
   ALTURA DO LEITO DE RESFRIAMENTO (METROS)                    3.360
   VELOCIDADE DE RETORTAGEM (KG/H.M2)                       1915.800
   VELOCIDADE DE RETORTAGEM (LB/H.FT2)                       392.356
   TEMPERATURA DE PIROLISE (TR-3/5) ('C)                     498.000
   TEMPERATURA DE SAIDA DOS GASES (TR-10) ('C)               202.000
   RELACAO G/X (GAS/XISTO CRU UMIDO) (KG/KG)                   0.990
   RELACAO DOS RECICLOS (RG/RF) (KG/KG)                       12.900
   PERDA DE CARGA NO LEITO DE PIROLISE (CMHG)                  4.000
   RENDIMENTO EM OLEO S/ENSAIO FISCHER (% PESO)              100.000
   RENDIMENTO EM GAS S/ENSAIO FISCHER (% PESO)                92.200
   RENDIMENTO EM OLEO+GAS S/ENSAIO FISCHER (% PESO)           98.800
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S I X / S E S I X
                                                                          R0457001
UNIDADE PILOTO    -   RESUMO DE DADOS
                                                                          PAGINA  2/7
=====================================================================================
BALANCO DE MATERIAL
                                                                          TESTE  213.1
=====================================================================================

ENTRA:          - XISTO CRU UMIDO (KG/H)                          61.830
                - VAPOR DO PRECIPITADOR (KG/H)                    10.000
                - TOTAL ENTRANDO (KG/H)                           71.830

SAI:            - OLEO COMPOSTO LIMPO (KG/H)                       7.190
                - GAS PRODUTO UMIDO (KG/H)                         1.170
                - AGUA (KG/H)                                      7.440
                - SOLIDOS ARRASTADOS (KG/H)                        0.170
                - XISTO RETORTADO (BAL. RETORTA)  (KG/H)          50.700
                - TOTAL SAINDO (KG/H)                             66.560
FECHAMENTO DO BALANCO MATERIAL (SAINDO/ENTRANDO) (%)              92.800


=====================================================================================
BALANCO DE AGUA
=====================================================================================

ENTRA:      - AGUA DE UMIDADE (KG/H)                               1.710
            - AGUA DE PIROLISE (KG/H)                              0.830
            - VAPOR DO PRECIPITADOR (KG/H)                        10.000
            - TOTAL ENTRANDO (KG/H)                               12.540

SAI:        - AGUA NO OLEO DO CICLONE (KG/H)                       0.790
            - AGUA NO OLEO DO PRECIPITADOR (KG/H)                  6.600
            - AGUA NO CONDENSADOR (KG/H)                           0.040
            - AGUA NO GAS PRODUTO (KG/H)                           0.290
            - TOTAL SAINDO (KG/H)                                  7.730
FECHAMENTO DO BALANCO DE AGUA (SAINDO/ENTRANDO) (%)               61.630
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S I X / S E S I X                                                          R0457001

UNIDADE PILOTO   -   RESUMO DE DADOS                                       PAGINA  3/7
==========================================================================================
          BALANCO DE CARBONO                                               TESTE  213.1
==========================================================================================

ENTRA:          - CARBONO NO XISTO CRU SECO (KG/H)                         9.970

SAI:            - CARBONO NO XISTO RETORTADO (KG/H)                        3.250
                - CARBONO NO OLEO COMPOSTO (KG/H)                          6.090
                - CARBONO NO GAS PRODUTO (KG/H)                            0.653
                - TOTAL SAINDO (KG/H)                                     10.002
FECHAMENTO DO BALANCO DE CARBONO (SAINDO/ENTRANDO) (%)                   100.340
==========================================================================================
          BALANCO DE HIDROGENIO
==========================================================================================

ENTRA:             - HIDROGENIO NO XISTO CRU SECO (KG/H)                   1.320

SAI:               - HIDROGENIO NO XISTO RETORTADO (KG/H)                  0.230
                   - HIDROGENIO NO OLEO COMPOSTO (KG/H)                    0.868
                   - HIDROGENIO NO GAS PRODUTO SECO (KG/H)                 0.163
                   - NA AGUA DE PIROLISE LIBERADA (KG/H)                   0.060
                   - TOTAL SAINDO (KG/H)                                   1.324
FECHAMENTO DO BALANCO DE HIDROGENIO (SAINDO/ENT.) (%)                    100.530
==========================================================================================
          BALANCO DE ENXOFRE
==========================================================================================

ENTRA:          - ENXOFRE NO XISTO CRU SECO (KG/H)                         0.625

SAI:            - ENXOFRE NO XISTO RETORTADO (KG/H)                        0.370
                - ENXOFRE NO OLEO COMPOSTO (KG/H)                          0.052
                - ENXOFRE NO GAS PRODUTO (KG/H)                            0.032
                - ENXOFRE NA AGUA DE RETORTAGEM (KG/H)                     0.015
                - TOTAL SAINDO (KG/H)                                      0.469
FECHAMENTO DO BALANCO DE ENXOFRE (SAINDO/ENTRANDO) (%)                    74.950
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S I X / S E S I X                                                              R0457001

UNIDADE PILOTO    -    RESUMO DE DADOS                                         PAGINA  4/7
==========================================================================================
      TEMPERATURAS
==========================================================================================
                                                                               TESTE  213.1
==========================================================================================

      TEMPERATURA DO RF NA ENTRADA DA RETORTA (TR-17) ('C)              117.000
      TEMPERATURA DO RQ NA ENTRADA DA RETORTA (TR-25/27) ('C)           504.000
      TEMPERATURA DO XISTO RETORTADO (TR-08) ('C)                       295.000
      TEMPERATURA DO TOPO DO LEITO (TR-01) ('C)                         340.000
      TEMPERATURA DO GAS PRODUTO UMIDO (TR-19) ('C)                      33.000

==========================================================================================
      PRESSOES
==========================================================================================

      PRESSAO NO FUNDO DA RETORTA (PR-07) (CMHG)                          4.460
      PRESSAO NO MEIO DO LEITO DE RESFRIAMENTO (PR-06) (CMHG)             4.440
      PRESSAO NO LEITO DE PIROLISE INJETOR INF (PR-05) (CMHG)             4.530
      PRESSAO NO LEITO DE PIROLISE INJETOR INT (PR-04) (CMHG)             3.900
      PRESSAO NO LEITO DE PIROLISE INJETOR SUP (PR-03) (CMHG)             4.230
      PRESSAO NO LEITO DE PIROLISE NIVEL MEDIO (PR-02) (CMHG)             1.910
      PRESSAO NO TOPO DO LEITO (PR-01) (CMHG)                             0.340
      PRESSAO NA SAIDA DOS GASES DA RETORTA (PRC-08) (CMHG)               0.220
      PRESSAO NA SUCCAO DO COMPRESSOR (PRC-09) (CMHG)                    -0.170

==========================================================================================
      VAZOES
==========================================================================================

      VAZAO DE XISTO CRU UMIDO (KG/H)                                    61.830
      VAZAO DE XISTO CRU SECO (KG/H)                                     60.120
      VAZAO DE OLEO DO CICLONE (SUJO) (KG/H)                              2.110
      VAZAO DE OLEO DO CICLONE (LIMPO) (KG/H)                             1.650
      VAZAO DE OLEO DO PRECIPITADOR (SUJO) (KG/H)                         5.180
      VAZAO DE OLEO DO PRECIPITADOR (LIMPO) (KG/H)                        4.670
      VAZAO DE OLEO LEVE (KG/H)                                           0.870
      VAZAO DE AGUA DE RETORTAGEM (TOTAL) (KG/H)                          7.440
      VAZAO DE GAS PRODUTO UMIDO (KG/H)                                   1.210
      VAZAO DE GAS DE RECICLO QUENTE (KG/H)                              56.700
      VAZAO DE GAS DE RECICLO FRIO (KG/H)                                 4.400
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 S I X / S E S                                                K015700;

 UNIDADE PILOTO   -   RESUMO DE DADOS                         PAGINA  5/7
=====================================================================================================
 PROPRIEDADES DOS FLUXOS
                                                                  TESTE  213.1
=====================================================================================================

 GRANULOMETRIA DA CARGA (- 1   + 3/4)                              0.000
 GRANULOMETRIA DA CARGA (- 3/4 + 1/2)                             62.600
 GRANULOMETRIA DA CARGA (- 1/2 + 1/4)                             37.400

 XISTO CRU - UMIDADE (% PESO)                                      2.770
 XISTO CRU - ENSAIO FISCHER - OLEO (% PESO)                       11.960
 XISTO CRU - ENSAIO FISCHER - AGUA (% PESO)                        1.380
 XISTO CRU - ENSAIO FISCHER - GAS+PERDAS (% PESO)                  2.110
 XISTO CRU - ENSAIO FISCHER - RESIDUO (% PESO)                    84.550
 XISTO CRU - PERDA AO FOGO (% PESO)                               28.460
 XISTO CRU - CARBONO TOTAL (% PESO)                               16.580
 XISTO CRU - CARBONO MINERAL (% PESO)                              2.560
 XISTO CRU - HIDROGENIO TOTAL (% PESO)                             2.190
 XISTO CRU - ENXOFRE (% PESO)                                      1.040
 XISTO CRU - PODER CALORIFICO SUPERIOR (KCAL/KG)                1651.000

 XISTO RETORTADO - ENSAIO FISCHER - OLEO (% PESO)                  0.000
 XISTO RETORTADO - ENSAIO FISCHER - AGUA (% PESO)                  0.580
 XISTO RETORTADO - ENSAIO FISCHER - GAS+PERDAS (% PESO)            0.020
 XISTO RETORTADO - ENSAIO FISCHER - RESIDUO (% PESO)              99.400
 XISTO RETORTADO - PERDA AO FOGO (% PESO)                         15.160
 XISTO RETORTADO - CARBONO TOTAL (% PESO)                          6.420
 XISTO RETORTADO - CARBONO MINERAL (% PESO)                        3.090
 XISTO RETORTADO - HIDROGENIO TOTAL (% PESO)                       0.460
 XISTO RETORTADO - ENXOFRE (% PESO)                                0.700
 XISTO RETORTADO - PODER CALORIFICO SUPERIOR (KCAL/KG)           311.000

 OLEO DO CICLONE SUJO - AGUA (% PESO)                             13.280
 OLEO DO CICLONE SUJO - SOLIDOS (% PESO)                           8.190
 OLEO DO CICLONE LIMPO - DENSIDADE 20/4 ('C)                       0.939
 OLEO DO CICLONE LIMPO - VISCOSIDADE A 54.4'C (CS)                56.200
 OLEO DO CICLONE LIMPO - VISCOSIDADE A 98.9'C (CS)                11.000
 OLEO DO PRECIPITADOR SUJO - AGUA (% PESO)                         9.940
 OLEO DO PRECIPITADOR SUJO - SOLIDOS (% PESO)                      0.040
 OLEO DO PRECIPITADOR LIMPO - DENSIDADE 20/4 ('C)                  0.925
 OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 38'C (CS)             49.600
 OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 54'C (CS)             23.470
 S I X  /  S F S I X
                                                                        R0457003
 UNIDADE PILOTO   -   RESUMO DE DADOS
                                                                        PAGINA  6/7
==========================================================================================
 PROPRIEDADES DOS FLUXOS
==========================================================================================
                                                                        TESTE  213.1
==========================================================================================

 OLEO LEVE - DENSIDADE 20/4 ('C)
 OLEO LEVE - PESO MOLECULAR (KG/KGMOL)                       0.793
 OLEO LEVE - PIE - ('C)                                    128.920
 OLEO LEVE - T10 - ('C)                                     75.000
 OLEO LEVE - T30 - ('C)                                    112.000
 OLEO LEVE - T50 - ('C)                                    145.000
 OLEO LEVE - T70 - ('C)                                    175.000
 OLEO LEVE - T90 - ('C)                                    206.000
                                                           253.000

 OLEO COMPOSTO LIMPO - DENSIDADE 20/4 ('C)
 OLEO COMPOSTO LIMPO - VISCOSIDADE A 38'C (CS)               0.910
 OLEO COMPOSTO LIMPO - VISCOSIDADE A 54'C (CS)              26.030
 OLEO COMPOSTO LIMPO - CARBONO RAMSBOTTON (% PESO)          14.460
 OLEO COMPOSTO LIMPO - CARBONO TOTAL (% PESO)                1.850
 OLEO COMPOSTO LIMPO - HIDROGENIO TOTAL (% PESO)            84.800
 OLEO COMPOSTO LIMPO - ENXOFRE (% PESO)                     12.080
 OLEO COMPOSTO LIMPO - NITROGENIO (% PESO)                   0.720
 OLEO COMPOSTO LIMPO - PODER CALORIF.SUPERIOR (KCAL/KG)      1.040
 OLEO COMPOSTO LIMPO - CINZAS (% PESO)                   10335.000
 OLEO COMPOSTO LIMPO - PONTO DE FULGOR ('C)                  0.070
 OLEO COMPOSTO LIMPO - PONTO DE FLUIDEZ ('C)                31.000
 OLEO COMPOSTO LIMPO - PIE - ('C)                           17.000
 OLEO COMPOSTO LIMPO - T10 - ('C)                           64.000
 OLEO COMPOSTO LIMPO - T30 - ('C)                          199.000
 OLEO COMPOSTO LIMPO - T50 - ('C)                          342.000
 OLEO COMPOSTO LIMPO - T70 - ('C)                          420.000
 OLEO COMPOSTO LIMPO - T90 - ('C)                          488.000
                                                           521.000

 GAS DE RECICLO - % GAS PRODUTO UMIDO (% MOL)
 GAS DE RECICLO - % OLEO LEVE (% MOL)                       12.640
 GAS DE RECICLO - % VAPOR DE AGUA (% MOL)                    1.570
 GAS DE RECICLO - PESO MOLECULAR (KG/KGMOL)                 85.790
 GAS DE RECICLO - COEFICIENTE (A)                           20.320
 GAS DE RECICLO - COEFICIENTE (B)                     0.325450E+00
 GAS DE RECICLO - COEFICIENTE (C)                     0.856568E-04
 GAS DE RECICLO - COEFICIENTE (D)                     0.385336E-06
                                                      -.257097E-09

 AGUA DE RETORTAGEM - ENXOFRE (G/L)
 AGUA DE RETORTAGEM - NITROGENIO AMONIACAL (G/L)             2.010
 AGUA DE RETORTAGEM - OLEO (G/L)                             4.790
 AGUA DE RETORTAGEM - FENOIS (PPM)                           0.230
 AGUA DE RETORTAGEM - PH                                   169.000
                                                             8.700
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         S I X  /  S E S I X                                                        R0457001
         UNIDADE PILOTO    -   RESUMO DE DADOS                                      PAGINA  7/7
==================================================================================================
                         ANALISE CROMATOGRAFICA - PERCENTAGEM MOLAR:                TESTE  213.1
==================================================================================================

              AMOSTRA NUMERO     45861            45862            MEDIA

H20                                  4.269            4.269            4.269
S02                                  0.000            0.000            0.000
H2S                                  1.874            1.806            1.840
O2                                   0.230            0.269            0.250
N2                                   9.812           10.720           10.266
CO                                   1.650            1.432            1.541
CO2                                  8.822            8.609            8.715
H2                                  32.185           32.997           32.591
METANO                              17.643           17.600           17.622
ETANO                                6.621            6.380            6.500
ETENO                                2.310            2.278            2.294
PROPANO                              3.152            3.025            3.089
PROPENO                              3.348            3.231            3.289
ISOBUTANO                            0.243            0.234            0.238
N-BUTANO                             1.532            1.455            1.493
ISOBUTENO+BUTENO1                    1.778            1.715            1.747
BUTENO 2T                            0.487            0.465            0.476
BUTENO 2C                            0.563            0.531            0.547
ISOPENTANO                           0.214            0.226            0.220
C5+                                  3.269            2.760            3.012
BUTADIENO+3M BUTENO1                 0.000            0.000            0.000
N-PENTANO                            0.000            0.000            0.000
PENTENO                              0.000            0.000            0.000
2M BUTENO1                           0.000            0.000            0.000
PENTENO 2T                           0.000            0.000            0.000
PENTENO 2C                           0.000            0.000            0.000
2M PENTANO+2M BUTENO2                0.000            0.000            0.000
3M PENTANO                           0.000            0.000            0.000
N HEXANO                             0.000            0.000            0.000
C6+                                  0.000            0.000            0.000
PESO MOLECULAR                      22.718           22.141           22.430
PC SUPERIOR    (KCAL/KG)          8343.685         8213.437         8278.561
PC INFERIOR    (KCAL/KG)          7618.207         7491.521         7554.864
COEFICIENTE (A)               0.209836E+00     0.219231E+00     0.214534E+00
COEFICIENTE (B)               0.888415E-03     0.857170E-03     0.872792E-03
COEFICIENTE (C)              -0.320486E-06    -0.302180E-06    -0.311333E-06
COEFICIENTE (D)               0.325013E-10     0.274275E-10     0.299644E-10

==================================================================================================

      COEFICIENTES DA EXPRESSAO      CP=A+BT+CT2+DT3:
      CP EM (KCAL/KG)   E  TEMPERATURA EM GRAU KELVIN
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TESTE NUMERO  213.1
                                                                                   R0457002
==========================================================================================

                          BALANCO DE ENERGIA - RETORTA PILOTO

==========================================================================================
                                KG/H           KCAL/KG          "C              KCAL/H
ENTRANDO NA RETORTA

XISTO CRU SECO                 60.120           6.1750          25.             371.244
UMIDADE                         1.713          25.0000          25.              42.820
RECICLO QUENTE                 56.695         221.2811         504.           12545.554
RECICLO FRIO                    4.395          45.2803         117.             199.016

TOTAL                         122.924                                         13158.634

SAINDO DA RETORTA

XISTO RETORTADO                50.696          76.4712         320.            3876.763
RECICLO QUENTE                 56.695          80.4574         202.            4561.542
RECICLO FRIO                    4.395          80.4574         202.             353.626
GAS PRODUTO                     1.211         100.6225         202.             121.804
SOLIDOS ARRASTADOS              0.175          51.6889         202.               9.025
OLEO DO CICLONE                 1.654         101.0000         202.             167.094
OLEO DO PRECIPITADOR            4.666         101.0000         202.             471.266
OLEO LEVE VAP                   0.867         178.2104         202.             154.455
AGUA DE RETORTAGEM              2.249         685.2134         202.            1540.702
DEC. CARBONATOS                                                                  71.778
DEC. PIRITAS                                                                     11.132
R. ENDOTERMICAS                                                                 138.277
PERDAS                                                                         1681.169

TOTAL                         122.607                                         13158.634
==========================================================================================
 DEMANDA TERMICA    =    99.43      KCAL/KG XISTO UMIDO

 BASE:   ENTALPIA=0  PARA T=0 "C

 ADOTADO APPROACH DE 25 "C NA TEMPERATURA DE SAIDA DO XISTO RETORTADO
```

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S I X  /  S E S I X                                                                      R0457001
UNIDADE PILOTO    -    RESUMO DE DADOS                                                  PAGINA  1/7
====================================================================================================

NUMERO DO TESTE (NUMERO.SERIE)                             213.200
INICIO DO TESTE                                           14/12/88
INICIO DO TESTE                                              22:45
DURACAO DO TESTE (HH.MM) (DECIMAL)                           6.000
ORIGEM DA CARGA                                      XISTO DE NEW BRUNSWICK
FAIXA GRANULOMETRICA DA CARGA                        1/4 A 3/4 POL
ALTURA DO LEITO DE PIROLISE (METROS)                         1.940
ALTURA DO LEITO DE RESFRIAMENTO (METROS)                     3.360
VELOCIDADE DE RETORTAGEM (KG/H.M2)                        2075.900
VELOCIDADE DE RETORTAGEM (LB/H.FT2)                        425.144
TEMPERATURA DE PIROLISE (TR-3/5) ('C)                      501.000
TEMPERATURA DE SAIDA DOS GASES (TR-10) ('C)                204.000
RELACAO G/X (GAS/XISTO CRU UMIDO) (KG/KG)                    1.040
RELACAO DOS RECICLOS (RQ/RF) (KG/KG)                        15.300
PERDA DE CARGA NO LEITO DE PIROLISE (CMHG)                   4.400
RENDIMENTO EM OLEO S/ENSAIO FISCHER (% PESO)               102.800
RENDIMENTO EM GAS S/ENSAIO FISCHER (% PESO)                 87.400
RENDIMENTO EM OLEO+GAS S/ENSAIO FISCHER (% PESO)           100.500
```

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S I X  /  S F S I X
                                                                          R0457001
UNIDADE PILOTO   -   RESUMO DE DADOS
                                                                          PAGINA  2/7
==========================================================================================
          BALANCO DE MATERIAL
                                                                          TESTE  213.2
==========================================================================================

ENTRA:           - XISTO CRU UMIDO (KG/H)                                 67.000
                 - VAPOR DO PRECIPITADOR (KG/H)                           10.000
                 - TOTAL ENTRANDO (KG/H)                                  77.000

SAI:             - OLEO COMPOSTO LIMPO (KG/H)                              8.010
                 - GAS PRODUTO UMIDO (KG/H)                                1.200
                 - AGUA (KG/H)                                            12.000
                 - SOLIDOS ARRASTADOS (KG/H)                               0.180
                 - XISTO RETORTADO (BAL. RETORTA)  (KG/H)                 55.530
                 - TOTAL SAINDO (KG/H)                                    76.920
FECHAMENTO DO BALANCO MATERIAL (SAINDO/ENTRANDO) (%)                      99.890


==========================================================================================
          BALANCO DE AGUA
==========================================================================================

ENTRA:       - AGUA DE UMIDADE (KG/H)                                      1.860
             - AGUA DE PIROLISE (KG/H)                                     0.900
             - VAPOR DO PRECIPITADOR (KG/H)                               10.000
             - TOTAL ENTRANDO (KG/H)                                      12.750

SAI:         - AGUA NO OLEO DO CICLONE (KG/H)                              1.350
             - AGUA NO OLEO DO PRECIPITADOR (KG/H)                        10.600
             - AGUA NO CONDENSADOR (KG/H)                                  0.050
             - AGUA NO GAS PRODUTO (KG/H)                                  0.250
             - TOTAL SAINDO (KG/H)                                        12.250
FECHAMENTO DO BALANCO DE AGUA (SAINDO/ENTRANDO) (%)                       96.040
```

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  S I X  /  S E S I X
                                                                              R0457005
  UNIDADE PILOTO   -   RESUMO DE DADOS
                                                                              PAGINA  3/7
==========================================================================================
  BALANCO DE CARBONO
==========================================================================================
                                                                              TESTE  213.2
==========================================================================================

ENTRA:        - CARBONO NO XISTO CRU SECO (KG/H)                       10.800

SAI:          - CARBONO NO XISTO RETORTADO (KG/H)                       3.560
              - CARBONO NO OLEO COMPOSTO (KG/H)                         6.790
              - CARBONO NO GAS PRODUTO (KG/H)                           0.625
              - TOTAL SAINDO (KG/H)                                    10.973
FECHAMENTO DO BALANCO DE CARBONO (SAINDO/ENTRANDO) (%)                101.590
==========================================================================================
  BALANCO DE HIDROGENIO
==========================================================================================

ENTRA:          - HIDROGENIO NO XISTO CRU SECO (KG/H)                   1.430

SAI:            - HIDROGENIO NO XISTO RETORTADO (KG/H)                  0.270
                - HIDROGENIO NO OLEO COMPOSTO (KG/H)                    0.974
                - HIDROGENIO NO GAS PRODUTO SECO (KG/H)                 0.155
                - NA AGUA DE PIROLISE LIBERADA (KG/H)                   0.072
                - TOTAL SAINDO (KG/H)                                   1.467
FECHAMENTO DO BALANCO DE HIDROGENIO (SAINDO/ENT.) (%)                 102.850
==========================================================================================
  BALANCO DE ENXOFRE
==========================================================================================

ENTRA:        - ENXOFRE NO XISTO CRU SECO (KG/H)                        0.677

SAI:          - ENXOFRE NO XISTO RETORTADO (KG/H)                       0.472
              - ENXOFRE NO OLEO COMPOSTO (KG/H)                         0.066
              - ENXOFRE NO GAS PRODUTO (KG/H)                           0.050
              - ENXOFRE NA AGUA DE RETORTAGEM (KG/H)                    0.084
              - TOTAL SAINDO (KG/H)                                     0.671
FECHAMENTO DO BALANCO DE ENXOFRE (SAINDO/ENTRANDO) (%)                 99.110
```

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          S I X  /  S E S I X                                                    R0457001

          UNIDADE PILOTO    -    RESUMO DE DADOS                                 PAGINA  4/7
=====================================================================================================
          TEMPERATURAS                                                           TESTE  213.2
=====================================================================================================

          TEMPERATURA DO RF NA ENTRADA DA RETORTA (TR-17) ('C)            122.000
          TEMPERATURA DO RQ NA ENTRADA DA RETORTA (TR-25/27) ('C).        513.000
          TEMPERATURA DO XISTO RETORTADO (TR-08) ('C)                     291.000
          TEMPERATURA DO TOPO DO LEITO (TR-01) ('C)                       353.000
          TEMPERATURA DO GAS-PRODUTO UMIDO (TR-19) ('C)                    38.000

=====================================================================================================
          PRESSOES
=====================================================================================================

          PRESSAO NO FUNDO DA RETORTA (PR-07) (CMHG)                        4.880
          PRESSAO NO MEIO DO LEITO DE RESFRIAMENTO (PR-06) (CMHG)           4.890
          PRESSAO NO LEITO DE PIROLISE INJETOR INF (PR-05) (CMHG)           4.870
          PRESSAO NO LEITO DE PIROLISE INJETOR INT (PR-04) (CMHG)           4.030
          PRESSAO NO LEITO DE PIROLISE INJETOR SUP (PR-03) (CMHG)           4.620
          PRESSAO NO LEITO DE PIROLISE NIVEL MEDIO (PR-02) (CMHG)           2.300
          PRESSAO NO TOPO DO LEITO (PR-01) (CMHG)                           0.370
          PRESSAO NA SAIDA DOS GASES DA RETORTA (PRC-08) (CMHG)             0.220
          PRESSAO NA SUCCAO DO COMPRESSOR (PRC-09) (CMHG)                  -0.390

=====================================================================================================
          VAZOES
=====================================================================================================

          VAZAO DE XISTO CRU UMIDO (KG/H)                                  67.000
          VAZAO DE XISTO CRU SECO (KG/H)                                   65.140
          VAZAO DE OLEO DO CICLONE (SUJO) (KG/H)                            3.100
          VAZAO DE OLEO DO CICLONE (LIMPO) (KG/H)                           1.960
          VAZAO DE OLEO DO PRECIPITADOR (SUJO) (KG/H)                       5.330
          VAZAO DE OLEO DO PRECIPITADOR (LIMPO) (KG/H)                      4.950
          VAZAO DE OLEO LEVE (KG/H)                                         1.100
          VAZAO DE AGUA DE RETORTAGEM (TOTAL) (KG/H)                       12.000
          VAZAO DE GAS PRODUTO UMIDO (KG/H)                                 1.250
          VAZAO DE GAS DE RECICLO QUENTE (KG/H)                            65.390
          VAZAO DE GAS DE RECICLO FRIO (KG/H)                               4.270
```

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S I X  /  S E S I X                                                                     R0457001

UNIDADE PILOTO    -    RESUMO DE DADOS                                                  PAGINA  5/7
=====================================================================================================
    PROPRIEDADES DOS FLUXOS                                                             TESTE  213.2
=====================================================================================================

        GRANULOMETRIA DA CARGA (- 1   + 3/4)                                    0.000
        GRANULOMETRIA DA CARGA (- 3/4 + 1/2)                                   62.600
        GRANULOMETRIA DA CARGA (- 1/2 + 1/4)                                   37.400

        XISTO CRU - UMIDADE (% PESO)                                            2.770
        XISTO CRU - ENSAIO FISCHER - OLEO (% PESO)                             11.960
        XISTO CRU - ENSAIO FISCHER - AGUA (% PESO)                              1.300
        XISTO CRU - ENSAIO FISCHER - GAS+PERDAS (% PESO)                        2.110
        XISTO CRU - ENSAIO FISCHER - RESIDUO (% PESO)                          84.550
        XISTO CRU - PERDA AO FOGO (% PESO)                                     28.460
        XISTO CRU - CARBONO TOTAL (% PESO)                                     16.580
        XISTO CRU - CARBONO MINERAL (% PESO)                                    2.560
        XISTO CRU - HIDROGENIO TOTAL (% PESO)                                   2.190
        XISTO CRU - ENXOFRE (% PESO)                                            1.040
        XISTO CRU - PODER CALORIFICO SUPERIOR (KCAL/KG)                      1651.000

        XISTO RETORTADO - ENSAIO FISCHER - OLEO (% PESO)                        0.120
        XISTO RETORTADO - ENSAIO FISCHER - AGUA (% PESO)                        0.450
        XISTO RETORTADO - ENSAIO FISCHER - GAS+PERDAS (% PESO)                  0.020
        XISTO RETORTADO - ENSAIO FISCHER - RESIDUO (% PESO)                    99.410
        XISTO RETORTADO - PERDA AO FOGO (% PESO)                               16.080
        XISTO RETORTADO - CARBONO TOTAL (% PESO)                                6.410
        XISTO RETORTADO - CARBONO MINERAL (% PESO)                              3.120
        XISTO RETORTADO - HIDROGENIO TOTAL (% PESO)                             0.480
        XISTO RETORTADO - ENXOFRE (% PESO)                                      0.900
        XISTO RETORTADO - PODER CALORIFICO SUPERIOR (KCAL/KG)                 312.000

        OLEO DO CICLONE SUJO - AGUA (% PESO)                                   31.310
        OLEO DO CICLONE SUJO - SOLIDOS (% PESO)                                 5.490
        OLEO DO CICLONE LIMPO - DENSIDADE 20/4 ('C)                             0.942
        OLEO DO CICLONE LIMPO - VISCOSIDADE A 54.4'C (CS)                      82.600
        OLEO DO CICLONE LIMPO - VISCOSIDADE A 98.9'C (CS)                      14.100
        OLEO DO PRECIPITADOR SUJO - AGUA (% PESO)                               7.070
        OLEO DO PRECIPITADOR SUJO - SOLIDOS (% PESO)                            0.110
        OLEO DO PRECIPITADOR LIMPO - DENSIDADE 20/4 ('C)                        0.925
        OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 38'C (CS)                   52.000
        OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 54'C (CS)                   24.330
```

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       S I X  /  S E S I X
                                                                        R0457001
       UNIDADE PILOTO   -   RESUMO DE DADOS
=========================================================================       PAGINA  4/7
       PROPRIEDADES DOS FLUXOS
=================================================================================================
                                                                        TESTE  213.2
=================================================================================================

      OLEO LEVE - DENSIDADE 20/4 ('C)
      OLEO LEVE - PESO MOLECULAR (KG/KGMOL)                                  0.784
      OLEO LEVE - PIE - ('C)                                               124.510
      OLEO LEVE - T10 - ('C)                                                65.000
      OLEO LEVE - T30 - ('C)                                               103.000
      OLEO LEVE - T50 - ('C)                                               137.000
      OLEO LEVE - T70 - ('C)                                               169.000
      OLEO LEVE - T90 - ('C)                                               204.000
                                                                           251.000

      OLEO COMPOSTO LIMPO - DENSIDADE 20/4 ('C)
      OLEO COMPOSTO LIMPO - VISCOSIDADE A 38'C (CS)                          0.909
      OLEO COMPOSTO LIMPO - VISCOSIDADE A 54'C (CS)                         24.700
      OLEO COMPOSTO LIMPO - CARBONO RAMSBOTTON (% PESO)                     13.420
      OLEO COMPOSTO LIMPO - CARBONO TOTAL (% PESO)                           2.060
      OLEO COMPOSTO LIMPO - HIDROGENIO TOTAL (% PESO)                       84.780
      OLEO COMPOSTO LIMPO - ENXOFRE (% PESO)                                12.160
      OLEO COMPOSTO LIMPO - NITROGENIO (% PESO)                              0.820
      OLEO COMPOSTO LIMPO - PODER CALORIF.SUPERIOR (KCAL/KG)                 1.000
      OLEO COMPOSTO LIMPO - CINZAS (% PESO)                              10399.000
      OLEO COMPOSTO LIMPO - PONTO DE FULGOR ('C)                             0.020
      OLEO COMPOSTO LIMPO - PONTO DE FLUIDEZ ('C)                           34.000
      OLEO COMPOSTO LIMPO - PIE - ('C)                                      17.000
      OLEO COMPOSTO LIMPO - T10 - ('C)                                      69.000
      OLEO COMPOSTO LIMPO - T30 - ('C)                                     195.000
      OLEO COMPOSTO LIMPO - T50 - ('C)                                     343.000
      OLEO COMPOSTO LIMPO - T70 - ('C)                                     420.000
      OLEO COMPOSTO LIMPO - T90 - ('C)                                     491.000
                                                                           525.000

      GAS DE RECICLO - % GAS PRODUTO UMIDO (% MOL)
      GAS DE RECICLO - % OLEO LEVE (% MOL)                                   8.450
      GAS DE RECICLO - % VAPOR DE AGUA (% MOL)                               1.350
      GAS DE RECICLO - PESO MOLECULAR (KG/KGMOL)                            90.190
      GAS DE RECICLO - COEFICIENTE (A)                                      19.858
      GAS DE RECICLO - COEFICIENTE (B)                                0.348589E+00
      GAS DE RECICLO - COEFICIENTE (C)                                0.152441E-04
      GAS DE RECICLO - COEFICIENTE (D)                                0.445814E-06
                                                                      -.279126E-09

      AGUA DE RETORTAGEM - ENXOFRE (G/L)
      AGUA DE RETORTAGEM - NITROGENIO AMONIACAL (G/L)                        7.010
      AGUA DE RETORTAGEM - OLEO (G/L)                                        6.870
      AGUA DE RETORTAGEM - FENOIS (PPM)                                      0.230
      AGUA DE RETORTAGEM - PH                                              144.000
                                                                             9.300
```

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         S I X  /  S E S I X                                                    R0457001

         UNIDADE PILOTO    -    RESUMO DE DADOS                                 PAGINA  7/7
==========================================================================================
                      ANALISE CROMATOGRAFICA - PERCENTAGEM MOLAR:               TESTE  213.2
==========================================================================================

            AMOSTRA NUMERO       45863          45864            MEDIA
   H2O                             5.349          5.349            5.349
   SO2                             0.000          0.000            0.000
   H2S                             2.844          2.773            2.809
   O2                              0.342          0.193            0.268
   N2                             13.610         11.975           12.792
   CO                              1.141          1.502            1.322
   CO2                             9.280          8.858            9.069
   H2                             30.896         31.283           31.090
   METANO                         16.482         16.683           16.583
   ETANO                           5.870          6.012            5.941
   ETENO                           2.087          2.096            2.091
   PROPANO                         2.593          2.672            2.632
   PROPENO                         2.670          2.770            2.720
   ISOBUTANO                       0.218          0.231            0.225
   N-BUTANO                        1.203          1.244            1.224
   ISOBUTENO+BUTENO1               1.358          1.426            1.392
   BUTENO 2T                       0.393          0.406            0.400
   BUTENO 2C                       0.444          0.461            0.452
   ISOPENTANO                      0.192          0.199            0.196
   C5+                             3.029          3.868            3.447
   BUTADIENO+3M BUTENO1            0.000          0.000            0.000
   N-PENTANO                       0.000          0.000            0.000
   PENTENO                         0.000          0.000            0.000
   2M BUTENO1                      0.000          0.000            0.000
   PENTENO 2T                      0.000          0.000            0.000
   PENTENO 2C                      0.000          0.000            0.000
   2M PENTANO+2M BUTENO2           0.000          0.000            0.000
   3M PENTANO                      0.000          0.000            0.000
   N HEXANO                        0.000          0.000            0.000
   C6+                             0.000          0.000            0.000
   PESO MOLECULAR                 22.614         22.883           22.749
   PC SUPERIOR    (KCAL/KG)     7451.405       7829.847         7640.626
   PC INFERIOR    (KCAL/KG)     6794.307       7146.958         6970.633
   COEFICIENTE (A)          0.221359E+00   0.214965E+00     0.218162E+00
   COEFICIENTE (B)          0.783197E-03   0.838551E-03     0.810874E-03
   COEFICIENTE (C)         -0.261033E-06  -0.289002E-06    -0.275017E-06
   COEFICIENTE (D)          0.166051E-10   0.238058E-10     0.202054E-10
==========================================================================================

       COEFICIENTES DA EXPRESSAO      CP=A+BT+CT2+DT3:
       CP EM (KCAL/KG)  E  TEMPERATURA EM GRAU KELVIN
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TESTE NUMERO  213.2
                                                                                R0457002
========================================================================================

                          BALANCO DE ENERGIA - RETORTA PILOTO

========================================================================================

                          KG/H            KCAL/KG           "C              KCAL/H
ENTRANDO NA RETORTA


XISTO CRU SECO          65.144             6.1750           25.            402.265
UMIDADE                  1.856            25.0000           25.             46.398
RECICLO QUENTE          65.386           225.8763          513.          14769.103
RECICLO FRIO             4.273            47.9768          122.            205.005

TOTAL                  136.659                                           15422.770

SAINDO DA RETORTA


XISTO RETORTADO         55.534            75.4135          316.           4188.007
RECICLO QUENTE          65.386            82.1651          204.           5372.434
RECICLO FRIO             4.273            82.1651          204.            351.092
GAS PRODUTO              1.254            98.7050          204.            123.786
SOLIDOS ARRASTADOS       0.176            52.3233          204.              9.204
OLEO DO CICLONE          1.957           102.0000          204.            199.624
OLEO DO PRECIPITADOR     4.950           102.0000          204.            504.941
OLEO LEVE VAP            1.100           179.1865          204.            197.105
AGUA DE RETORTAGEM       2.505           686.1312          204.           1718.759
DEC. CARBONATOS                                                             74.877
DEC. PIRITAS                                                                17.359
R. ENDOTERMICAS                                                            149.831
PERDAS                                                                    2515.751

TOTAL                  137.135                                           15422.770
========================================================================================

 DEMANDA TERMICA   =    100.52      KCAL/KG XISTO UMIDO

 BASE:   ENTALPIA=0  PARA T=0 "C

 ADOTADO APPROACH DE 25 "C NA TEMPERATURA DE SAIDA DO XISTO RETORTADO
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S I X  /  S E S I X  .                                                  R0457001

UNIDADE PILOTO    -    RESUMO DE DADOS                                  PAGINA  1/7
=====================================================================================================

NUMERO DO TESTE (NUMERO.SERIE)                                 213.300
INICIO DO TESTE                                               15/12/88
INICIO DO TESTE                                                   4:45
DURACAO DO TESTE (HH.MM) (DECIMAL)                               5.000
ORIGEM DA CARGA                                    XISTO DE NEW BRUNSWICK
FAIXA GRANULOMETRICA DA CARGA                      1/4 A 3/4 POL
ALTURA DO LEITO DE PIROLISE (METROS)                             1.940
ALTURA DO LEITO DE RESFRIAMENTO (METROS)                         3.360
VELOCIDADE DE RETORTAGEM (KG/H.M2)                            2193.600
VELOCIDADE DE RETORTAGEM (LB/H.FT2)                            449.249
TEMPERATURA DE PIROLISE (TR-3/5) ('C)                          505.000
TEMPERATURA DE SAIDA DOS GASES (TR-10) ('C)                    205.000
RELACAO G/X (GAS/XISTO CRU UMIDO) (KG/KG)                        0.940
RELACAO DOS RECICLOS (RG/RF) (KG/KG)                            13.980
PERDA DE CARGA NO LEITO DE PIROLISE (CMHG)                       5.200
RENDIMENTO EM OLEO S/ENSAIO FISCHER (% PESO)                   101.300
RENDIMENTO EM GAS S/ENSAIO FISCHER (% PESO)                     89.000
RENDIMENTO EM OLEO+GAS S/ENSAIO FISCHER (% PESO)                99.400
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S I X / S E S I X
                                                                    R0457001
UNIDADE PILOTO   -   RESUMO DE DADOS
                                                                   PAGINA  2/7
================================================================================
   BALANCO DE MATERIAL
================================================================================
                                                                   TESTE  213.3
================================================================================

ENTRA:           - XISTO CRU UMIDO (KG/H)
                 - VAPOR DO PRECIPITADOR (KG/H)                      70.800
                 - TOTAL ENTRANDO (KG/H)                             10.000
                                                                     80.800

SAI:             - OLEO COMPOSTO LIMPO (KG/H)
                 - GAS PRODUTO UMIDO (KG/H)                           8.340
                 - AGUA (KG/H)                                        1.290
                 - SOLIDOS ARRASTADOS (KG/H)                         11.270
                 - XISTO RETORTADO (BAL. RETORTA)  (KG/H)             0.590
                 - TOTAL SAINDO (KG/H)                               58.500
FECHAMENTO DO BALANCO MATERIAL (SAINDO/ENTRANDO) (%)                 79.990
                                                                     99.000


================================================================================
   BALANCO DE AGUA
================================================================================

ENTRA:        - AGUA DE UMIDADE (KG/H)
              - AGUA DE PIROLISE (KG/H)                               1.960
              - VAPOR DO PRECIPITADOR (KG/H)                          0.950
              - TOTAL ENTRANDO (KG/H)                                10.000
                                                                     12.910

SAI:          - AGUA NO OLEO DO CICLONE (KG/H)
              - AGUA NO OLEO DO PRECIPITADOR (KG/H)                   1.170
              - AGUA NO CONDENSADOR (KG/H)                           10.040
              - AGUA NO GAS PRODUTO (KG/H)                            0.030
              - TOTAL SAINDO (KG/H)                                   0.330
FECHAMENTO DO BALANCO DE AGUA (SAINDO/ENTRANDO) (%)                  11.600
                                                                     89.810
```

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S I X / [illegible]                                                              F645706

UNIDADE PILOTO   -   RESUMO DE DADOS                                            PAGINA  3/7
===============================================================================================
BALANCO DE CARBONO                                                              TESTE  213.2
===============================================================================================

ENTRA:          - CARBONO NO XISTO CRU SECO (KG/H)                  11.410

SAI:            - CARBONO NO XISTO RETORTADO (KG/H)                  3.880
                - CARBONO NO OLEO COMPOSTO (KG/H)                    7.090
                - CARBONO NO GAS PRODUTO (KG/H)                      0.719
                - TOTAL SAINDO (KG/H)                               11.695
FECHAMENTO DO BALANCO DE CARBONO (SAINDO/ENTRANDO) (%)             102.460

===============================================================================================
BALANCO DE HIDROGENIO
===============================================================================================

ENTRA:            - HIDROGENIO NO XISTO CRU SECO (KG/H)              1.510

SAI:              - HIDROGENIO NO XISTO RETORTADO (KG/H)             0.280
                  - HIDROGENIO NO OLEO COMPOSTO (KG/H)               0.992
                  - HIDROGENIO NO GAS PRODUTO SECO (KG/H)            0.179
                  - NA AGUA DE PIROLISE LIBERADA (KG/H)              0.049
                  - TOTAL SAINDO (KG/H)                              1.521
FECHAMENTO DO BALANCO DE HIDROGENIO (SAINDO/ENT.) (%)              100.910

===============================================================================================
BALANCO DE ENXOFRE
===============================================================================================

ENTRA:          - ENXOFRE NO XISTO CRU SECO (KG/H)                   0.716

SAI:            - ENXOFRE NO XISTO RETORTADO (KG/H)                  0.275
                - ENXOFRE NO OLEO COMPOSTO (KG/H)                    0.068
                - ENXOFRE NO GAS PRODUTO (KG/H)                      0.056
                - ENXOFRE NA AGUA DE RETORTAGEM (KG/H)               0.089
                - TOTAL SAINDO (KG/H)                                0.488
FECHAMENTO DO BALANCO DE ENXOFRE (SAINDO/ENTRANDO) (%)              68.130
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SIX / SEGIX                                                                       80457001
UNIDADE PILOTO   -   RESUMO DE DADOS                                              PAGINA  4/7
==================================================================================================
TEMPERATURAS
                                                                                  TESTE  213.3
==================================================================================================

TEMPERATURA DO RF NA ENTRADA DA RETORTA (TR-17) ('C)                126.000
TEMPERATURA DO RQ NA ENTRADA DA RETORTA (TR-25/27) ('C)             515.000
TEMPERATURA DO XISTO RETORTADO (TR-08) ('C)                         410.000
TEMPERATURA DO TOPO DO LEITO (TR-01) ('C)                           351.000
TEMPERATURA DO GAS PRODUTO UMIDO (TR-19) ('C)                        29.000

==================================================================================================
PRESSOES
==================================================================================================

PRESSAO NO FUNDO DA RETORTA (PR-07) (CMHG)                            5.630
PRESSAO NO MEIO DO LEITO DE RESFRIAMENTO (PR-06) (CMHG)               5.630
PRESSAO NO LEITO DE PIROLISE INJETOR INF (PR-05) (CMHG)               5.400
PRESSAO NO LEITO DE PIROLISE INJETOR INT (PR-04) (CMHG)               4.830
PRESSAO NO LEITO DE PIROLISE INJETOR SUP (PR-03) (CMHG)               5.470
PRESSAO NO LEITO DE PIROLISE NIVEL MEDIO (PR-02) (CMHG)               3.330
PRESSAO NO TOPO DO LEITO (PR-01) (CMHG)                               0.530
PRESSAO NA SAIDA DOS GASES DA RETORTA (PRC-08) (CMHG)                 0.220
PRESSAO NA SUCCAO DO COMPRESSOR (PRC-09) (CMHG)                      -1.260

==================================================================================================
VAZOES
==================================================================================================

VAZAO DE XISTO CRU UMIDO (KG/H)                                      70.800
VAZAO DE XISTO CRU SECO (KG/H)                                       60.840
VAZAO DE OLEO DO CICLONE (SUJO) (KG/H)                                4.890
VAZAO DE OLEO DO CICLONE (LIMPO) (KG/H)                               3.300
VAZAO DE OLEO DO PRECIPITADOR (SUJO) (KG/H)                           4.030
VAZAO DE OLEO DO PRECIPITADOR (LIMPO) (KG/H)                          3.860
VAZAO DE OLEO LEVE (KG/H)                                             1.180
VAZAO DE AGUA DE RETORTAGEM (TOTAL) (KG/H)                           11.270
VAZAO DE GAS PRODUTO UMIDO (KG/H)                                     1.320
VAZAO DE GAS DE RECICLO QUENTE (KG/H)                                62.020
VAZAO DE GAS DE RECICLO FRIO (KG/H)                                   4.440
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SIX / SEBIX                                                        R0457001

UNIDADE PILOTO   -   RESUMO DE DADOS                               PAGINA  5/7
==================================================================================
  PROPRIEDADES DOS FLUXOS                                          TESTE  213.3
==================================================================================

    GRANULOMETRIA DA CARGA (- 1   + 3/4)                             0.000
    GRANULOMETRIA DA CARGA (- 3/4 + 1/2)                            62.600
    GRANULOMETRIA DA CARGA (- 1/2 + 1/4)                            37.400

    XISTO CRU - UMIDADE (% PESO)                                     2.770
    XISTO CRU - ENSAIO FISCHER - OLEO (% PESO)                      11.960
    XISTO CRU - ENSAIO FISCHER - AGUA (% PESO)                       1.380
    XISTO CRU - ENSAIO FISCHER - GAS+PERDAS (% PESO)                 2.110
    XISTO CRU - ENSAIO FISCHER - RESIDUO (% PESO)                   84.550
    XISTO CRU - PERDA AO FOGO (% PESO)                              28.460
    XISTO CRU - CARBONO TOTAL (% PESO)                              16.580
    XISTO CRU - CARBONO MINERAL (% PESO)                             2.560
    XISTO CRU - HIDROGENIO TOTAL (% PESO)                            2.190
    XISTO CRU - ENXOFRE (% PESO)                                     1.040
    XISTO CRU - PODER CALORIFICO SUPERIOR (KCAL/KG)               1651.000

    XISTO RETORTADO - ENSAIO FISCHER - OLEO (% PESO)                 0.190
    XISTO RETORTADO - ENSAIO FISCHER - AGUA (% PESO)                 0.560
    XISTO RETORTADO - ENSAIO FISCHER - GAS+PERDAS (% PESO)           0.010
    XISTO RETORTADO - ENSAIO FISCHER - RESIDUO (% PESO)             99.240
    XISTO RETORTADO - PERDA AO FOGO (% PESO)                        15.820
    XISTO RETORTADO - CARBONO TOTAL (% PESO)                         6.640
    XISTO RETORTADO - CARBONO MINERAL (% PESO)                       3.040
    XISTO RETORTADO - HIDROGENIO TOTAL (% PESO)                      0.480
    XISTO RETORTADO - ENXOFRE (% PESO)                               0.500
    XISTO RETORTADO - PODER CALORIFICO SUPERIOR (KCAL/KG)          345.000

    OLEO DO CICLONE SUJO - AGUA (% PESO)                            20.670
    OLEO DO CICLONE SUJO - SOLIDOS (% PESO)                         11.930
    OLEO DO CICLONE LIMPO - DENSIDADE 20/4 ('C)                      0.941
    OLEO DO CICLONE LIMPO - VISCOSIDADE A 54.4'C (CS)               67.600
    OLEO DO CICLONE LIMPO - VISCOSIDADE A 98.9'C (CS)               11.900
    OLEO DO PRECIPITADOR SUJO - AGUA (% PESO)                        4.060
    OLEO DO PRECIPITADOR SUJO - SOLIDOS (% PESO)                     0.150
    OLEO DO PRECIPITADOR LIMPO - DENSIDADE 20/4 ('C)                 0.921
    OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 38'C (CS)            34.000
    OLEO DO PRECIPITADOR LIMPO - VISCOSIDADE A 54'C (CS)            17.800
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SIX / SESIX                                                                R0457001
UNIDADE PILOTO    -    RESUMO DE DADOS                                     PAGINA  6/7
===========================================================================================
PROPRIEDADES DOS FLUXOS
                                                                           TESTE  213.3
===========================================================================================

OLEO LEVE - DENSIDADE 20/4 ('C)                                  0.792
OLEO LEVE - PESO MOLECULAR (KG/KGMOL)                          127.050
OLEO LEVE - PIE - ('C)                                          71.000
OLEO LEVE - T10 - ('C)                                         107.000
OLEO LEVE - T30 - ('C)                                         142.000
OLEO LEVE - T50 - ('C)                                         174.000
OLEO LEVE - T70 - ('C)                                         209.000
OLEO LEVE - T90 - ('C)                                         256.000

OLEO COMPOSTO LIMPO - DENSIDADE 20/4 ('C)                        0.911
OLEO COMPOSTO LIMPO - VISCOSIDADE A 38'C (CS)                   25.100
OLEO COMPOSTO LIMPO - VISCOSIDADE A 54'C (CS)                   12.430
OLEO COMPOSTO LIMPO - CARBONO RAMSBOTTON (% PESO)                2.130
OLEO COMPOSTO LIMPO - CARBONO TOTAL (% PESO)                    85.050
OLEO COMPOSTO LIMPO - HIDROGENIO TOTAL (% PESO)                 11.900
OLEO COMPOSTO LIMPO - ENXOFRE (% PESO)                           0.810
OLEO COMPOSTO LIMPO - NITROGENIO (% PESO)                        1.140
OLEO COMPOSTO LIMPO - PODER CALORIF.SUPERIOR (KCAL/KG)       10393.000
OLEO COMPOSTO LIMPO - CINZAS (% PESO)                            0.080
OLEO COMPOSTO LIMPO - PONTO DE FULGOR ('C)                      28.000
OLEO COMPOSTO LIMPO - PONTO DE FLUIDEZ ('C)                     12.000
OLEO COMPOSTO LIMPO - PIE - ('C)                                63.000
OLEO COMPOSTO LIMPO - T10 - ('C)                               202.000
OLEO COMPOSTO LIMPO - T30 - ('C)                               345.000
OLEO COMPOSTO LIMPO - T50 - ('C)                               428.000
OLEO COMPOSTO LIMPO - T70 - ('C)                               493.000
OLEO COMPOSTO LIMPO - T90 - ('C)                               536.000

GAS DE RECICLO - % GAS PRODUTO UMIDO (% MOL)                     9.160
GAS DE RECICLO - % OLEO LEVE (% MOL)                             1.490
GAS DE RECICLO - % VAPOR DE AGUA (% MOL)                        89.360
GAS DE RECICLO - PESO MOLECULAR (KG/KGMOL)                      20.107
GAS DE RECICLO - COEFICIENTE (A)                          0.337514E+00
GAS DE RECICLO - COEFICIENTE (B)                          0.447196E-04
GAS DE RECICLO - COEFICIENTE (C)                          0.422374E-06
GAS DE RECICLO - COEFICIENTE (D)                          -.271252E-09

AGUA DE RETORTAGEM - ENXOFRE (G/L)                               7.900
AGUA DE RETORTAGEM - NITROGENIO AMONIACAL (G/L)                  8.770
AGUA DE RETORTAGEM - OLEO (G/L)                                  0.090
AGUA DE RETORTAGEM - FENOIS (PPM)                              165.000
AGUA DE RETORTAGEM - PH                                          9.200
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        S I X  /  S E S I X                                                                        R0457001

        UNIDADE PILOTO   -   RESUMO DE DADOS
                                                                                                   PAGINA  7/7
=================================================================================================================
                                ANALISE CROMATOGRAFICA - PERCENTAGEM MOLAR:                        TESTE  213.3
=================================================================================================================

                   AMOSTRA NUMERO      45065          45066          MEDIA

  H2O                                  3.221          3.221          3.221
  SO2                                  0.000          0.000          0.000
  H2S                                  3.127          3.006          3.067
  O2                                   0.203          0.170          0.186
  N2                                   9.302         11.696         10.499
  CO                                   1.390          1.360          1.375
  CO2                                  8.816          8.698          8.757
  H2                                  33.222         31.274         32.248
  METANO                              18.089         17.307         17.698
  ETANO                                6.191          5.906          6.049
  ETENO                                2.357          2.161          2.259
  PROPANO                              2.703          2.876          2.789
  PROPENO                              2.949          3.069          3.009
  ISOBUTANO                            0.230          0.246          0.238
  N-BUTANO                             1.299          1.446          1.372
  ISOBUTENO+BUTENO1                    1.552          1.680          1.616
  BUTENO 2T                            0.478          0.513          0.495
  BUTENO 2C                            0.529          0.577          0.553
  ISOPENTANO                           0.214          0.228          0.221
  C5+                                  4.127          4.567          4.347
  BUTADIENO+3M BUTENO1                 0.000          0.000          0.000
  N-PENTANO                            0.000          0.000          0.000
  PENTENO                              0.000          0.000          0.000
  2M BUTENO1                           0.000          0.000          0.000
  PENTENO 2T                           0.000          0.000          0.000
  PENTENO 2C                           0.000          0.000          0.000
  2M PENTANO+2M BUTENO2                0.000          0.000          0.000
  3M PENTANO                           0.000          0.000          0.000
  N HEXANO                             0.000          0.000          0.000
  C6+                                  0.000          0.000          0.000
  PESO MOLECULAR                      22.692         23.624         23.158
  PC SUPERIOR    (KCAL/KG)          8415.146       8210.852       8312.999
  PC INFERIOR    (KCAL/KG)          7681.373       7504.135       7592.754
  COEFICIENTE (A)                0.210875E+00   0.200934E+00   0.205905E+00
  COEFICIENTE (B)                0.900175E-03   0.899020E-03   0.899598E-03
  COEFICIENTE (C)               -0.325831E-06  -0.328290E-06  -0.327060E-06
  COEFICIENTE (D)                0.352787E-10   0.360416E-10   0.356601E-10
=================================================================================================================

     COEFICIENTES DA EXPRESSAO      CP=A+BT+CT2+DT3:
     CP EM (KCAL/KG)  E  TEMPERATURA EM GRAU KELVIN
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TESTE NUMERO  213.3
                                                                                R0457002
==========================================================================================

                          BALANCO DE ENERGIA - RETORTA PILOTO

==========================================================================================

                         KG/H             KCAL/KG              "C             KCAL/H
ENTRANDO NA RETORTA

XISTO CRU SECO          68.839
UMIDADE                  1.961             6.1750              25.            425.080
RECICLO QUENTE          62.016            25.0000              25.             49.030
RECICLO FRIO             4.436           226.3115             515.          14034.957
                                          49.1611             126.            218.074
TOTAL                  137.252
                                                                            14727.141
SAINDO DA RETORTA

XISTO RETORTADO         58.502
RECICLO QUENTE          62.016           107.8242             435.           6307.972
RECICLO FRIO             4.436            81.9888             205.           5084.624
GAS PRODUTO              1.325            81.9888             205.            363.694
SOLIDOS ARRASTADOS       0.590           102.2073             205.            135.466
OLEO DO CICLONE          3.297            52.6413             205.             31.043
OLEO DO PRECIPITADOR     3.860           102.5000             205.            337.963
OLEO LEVE VAP            1.180           102.5000             205.            395.481
AGUA DE RETORTAGEM       2.584           179.6756             205.            212.017
DEC. CARBONATOS                          686.5903             205.           1773.875
DEC. PIRITAS                                                                   76.369
R. ENDOTERMICAS                                                                19.677
PERDAS                                                                        158.329
                                                                             -169.569
TOTAL                  137.791
                                                                            14727.141
==========================================================================================

DEMANDA TERMICA   =    126.76    KCAL/KG XISTO UMIDO

BASE:   ENTALPIA=0  PARA T=0 "C

ADOTADO APPROACH DE 25 "C NA TEMPERATURA DE SAIDA DO XISTO RETORTADO
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PETROBRAS
SIX

U-45 BANCADA (PAINEL):

DATA: 10/12/88
T-OP: 2/2 1.2
I

HORA	VAZÕES (%)				PRESSÕES (cm Hg)														OPERADOR	GRUPO
	GÁS DE RECIC.		Gás p/ CS-4501	Gás do Rejeito	R - 4501							Sistema	CN - 4501		AQ-4501 (GRO)		Gás Reciclo Frio	Gás Rejeito		
	Quente	Frio			Topo	Aquec	Pirólise			Resfr.			Suc.	Desc.	Entrada	Saída				
	FRC 01	FRC 02	FR 03	FQ 04	PR 01	PR 02	PR 03	PR 04	PR 05	PR 06	PR 07	PRC 08	PRC 09	PR 10	PR 11	PR 12	PR 13	PR 14		
08:45	30	10		39461	0,15	1,91	3,52	—	3,52	3,52	3,52	0,22	-0,11	25,99	13,66	4,41	3,08	21,15	AF	
09:45	31	10		[illegible]	0,22	1,84	3,63	—	3,63	3,52	3,52	0,22	00	24,67	13,66	4,63	3,30	[illegible]	[illegible]	
10:45	31	10		39555	0,22	1,91	3,63	-	3,76	3,67	3,82	0,22	-0,11	23,39	13,66	4,63	3,52	14,30	[illegible]	
11:45	31	10		39601	0,22	1,91	3,63	-	3,35	3,67	3,82	0,22	-0,11	23,35	14,40	4,63	3,52	[illegible]	[illegible]	
12:45	31	10		[illegible]	0,22	1,91	3,63	-	3,35	3,67	3,96	0,22	-0,22	22,47	13,66	4,63	3,52	16,30	[illegible]	
13:45	31	10		[illegible]	0,22	1,91	3,63	-	3,85	3,52	3,82	0,22	-0,22	22,03	13,22	4,63	3,52	[illegible]	[illegible]	
14:45	27	10		39733	0,22	1,91	3,63	—	3,85	3,52	3,82	0,22	-0,22	22,47	12,34	4,41	3,52	15,86	AF	
15:45	23	7		39308	0,15	1,84	3,52	—	3,52	3,38	3,67	0,22	-0,33	22,41	11,89	4,41	3,52	[illegible]		
16:45	[illegible]	9		39351	0,15	1,91	[illegible]		3,96	3,67	3,96	0,22	-0,44	22,03	11,89	4,63	[illegible]	14,98		
	29,55	9,55		390	0,20	1,89	3,63	—	3,71	3,57	3,76	0,22	0,20	23,2[illegible]			3,41	11,23		
16:45	21	9		39351	0,15	1,91	3,85	—	3,96	3,67	3,96	0,22	-0,44	22,03	11,89	4,63	3,74	14,98		
17:45	35	13		39909	0,22	2,57	5,07	—	5,13	4,93	5,43	0,22	-1,21	22,03	18,06	6,17	5,07	14,54		
18:45	36	9		39969	0,22	2,72	5,29	-	5,51	5,14	5,43	0,22	-1,10	24,47	18,94	6,39	5,29	13,06		
19:45	36	9		40038	0,15	2,57	4,96	-	5,29	4,99	5,29	0,22	-0,99	25,11	18,06	[illegible]	5,01	13,82		
20:45	36	10		40100	0,22	2,42	4,74	—	4,96	4,85	5,14	0,22	-0,99	25,55	11,06	5,95	4,63	12,03		
21:45	35	10		40153	0,22	2,42	4,41	—	4,63	4,41	4,10	0,22	-0,77	21,37	17,18	5,51	4,41	23,79		
22:45	36	10		[illegible]	0,29	2,50	4,63	—	4,85	4,10	4,85	0,22	-0,77	26,87	17,62	5,73	4,41	23,19		
	34,42	10,0		361	0,21	2,44	4,70	-	4,91	4,62	4,97	0,22	0,30	24,73			4,66	19,57		

PETROBRAS
SIX

U-45 BANCADA (PAINEL E ALINHAMENTO DOS PRODUTOS)

DATA: 10/12/88
T-CP: 212-1.2

2

	TIR-1 (°C)					P-4501			MO 4501	MD-4501		CM 4501	
	CM-4501		GRO Antes AO	GÁS Reciclo Frio	GÁS Rejeito	PRIMÁRIO	SECUNDÁRIO		Kg	RPM	kg/h	%	OPERADOR
	SUC.	DESC.											
HORA	TR 12 ^{2}	TR 13 ^{3}	TR 14 ^{4}	TR 17 ^{5}	TR 19 ^{6}	Volt	m.Amp.	k.Volt	WI 01	SIC 01	Xisto	SIC 02	
08:45	140	120	150	95	20	390	10	42	1200	90	-	83	
09:45	120	110	150	100	25	390	10	42	1130	80	70	83	
10:05	120	110	150	130	25	390	10	42	105[illegible]	80	71	83	of.
11:45	125	110	155	120	25	390	9	42	990	80	69	83	of.
12:45	125	110	150	115	25	390	10	42	922	80	68	83	of.
13:05	125	115	155	110	28	390	9	42	851	80	71	83	of.
14:45	125	115	165	130	30	390	9	42	782	70	69	83	of.
15:45	125	115	165	115	30	390	10	42	712	65	70	83	
16:45	125	115	16.5	130	30	390	10	42	645	60	67	83	
			156	116	26				555		69,3		
			//	=	//				//				
16:45	125	115	165	130	30	390	10	42	645	60	67	83	
17:45	130	130	110	140	35	390	10	42	515	90	66	98	
18:45	130	140	180	135	35	390	10	42	494	100	85	100	
19:45	130	140	115	140	30	390	10	42	408	100	86	100	
20:45	130	140	140	140	30	390	10	42	318	100	90	100	
21:45	130	145	155	135	25	390	10	42	233	100	85	100	
22:45	130	145	16.5	140	25	390	10	42	144	100	89	100	
			164,28	137,14	30				501		81,1		

OBS.:-

PETROBRAS
SIX

U-45 BANCADA (PAINEL)

DATA: 10/12/88
T-OP: 212.1.2

3

TjR.-2 (°C)

	Saída de Gases	R-4501									6 FT		8 FT		AQ-4501		10 FT		AQ-4501		Comp. Ar e F.F.	Gás p/ ...	OPERADOR	GRUPO
		Topo	Secag.	Aquec.	Pirólise			Resfriamento		N	S	N	S	Câmara	G.R.Q.	N	S	Pele do Tubo					
HORA	TR 10	TR C9	TR 01	TR 02	TR 03	TR 04	TR 05	TR 06	TR 07	TR 08	TR 25	TR 28A	TR 26B	TR 15	TR 16	TR 27A	TR 27B	TR 20	TR 21	TR 23	TR 24		
08:45	195	220	350	435	490	495	490	495	330	150	510	-	-	500	500	-	-	520	330	205	100		
09:45	190	220	340	430	425	505	490	440	390	220	495	485	-	535	495	-	-	515	325	205	100		
10:45	195	220	360	425	470	490	490	440	425	270	500	490	-	545	500	-	-	530	330	205	100		
11:45	190	205	345	420	465	490	495	455	435	310	505	495	-	550	505	-	-	575	330	205	100		
12:45	195	220	355	420	465	495	500	470	445	335	505	495	-	545	505	-	-	535	335	205	100		
13:45	190	220	340	420	465	520	500	475	455	360	505	495	-	545	505	-	-	535	335	205	100		
14:45	195	135	340	415	465	500	500	475	460	380	505	495	-	540	505	-	-	530	340	205	100		
15:45	190	130	345	410	450	465	495	415	465	390	510	490	-	535	505	-	-	530	345	205	100		
16:45	190	125	345	405	435	450	495	415	465	395	510	495	-	540	505	-	-	535	345	205	100		
	192	131	346	420	465	490	495	466	430	312	505	504			503								
																				205	100		
16:45	190	125	345	405	435	450	495	415	465	395	510	495	-	540	505	-	-	535	345	205	100		
17:45	200	160	350	405	430	455	500	415	465	410	520	505	-	555	520	-	-	545	345	205	100		
18:45	200	160	350	405	440	500	505	480	465	415	520	510	-	555	525	-		550	345	205	105		
19:45	195	140	350	415	455	485	505	485	470	420	515	510	-	550	525	-	-	545	345	210	105		
20:45	200	135	340	415	455	510	510	485	475	425	520	510	-	550	520	-	-	545	345	205	105		
21:45	200	115	340	410	455	475	505	485	475	430	515	510	-	545	520	-	-	540	345	205	105		
22:45	195	135	350	410	445	490	505	480	475	435	515	505	-	545	515	-	-	540	345	210	105		
	197	139	346	409	445	481	504	481	470	419	516	506	-		519					206	104		

PETROBRAS
PETRÓLEO BRASILEIRO S.A.
SIX

U-45 BANCADA (ÁREA)

DATA: 10/12/83
T-OP: 212-1

4

HORA	AQ-4501 Chaminé	AQ-4501 Óleo Combustível	GÁS DE RECICLO	P-4501 GÁS	P-4501 Vapor de Cortina	CM-4502 ÓLEO DE SELAGEM Descarga da Bomba	Após Filtro	Retorno Óleo	Após [illegible]	MO 4501	GÁS P/ CS-4501	V-4501 A	V-4501 B	V-4502 A	V-4502 B	V-4503 A	V-4503 B	THI 02	OPERADOR	GRUPO
	Thi 07	Pgi 01	Pgi 06	Thi 12	FI 08	Pgi 07	Pgi 09	Pgi 10	Pgi 38	Thi 01	Pgi 05	Thi 03	Thi 04	Thi 05	Thi 06	Thi 08	Thi 09			
08:45	—	12,8	0,32	113	25	3,6	1,9	1,6	—	—	0,37	—	94	—	24	26	—			
09:45	—	13,6	0,30	114	25	3,5	1,9	1,6	—	—	0,33	—	108	—	23	—	24			
10:45	—	12,0	0,28	116	25	3,5	1,9	1,6	—	—	0,33	—	107	—	23	—	24			
11:45	—	11,8	0,28	117	25	3,5	1,9	1,6	3,6	—	0,32	—	108	—	24	—	25	30		
12:45	—	11,6	0,26	118	25	3,5	1,9	1,6	3,6	—	0,32	—	106	—	26	—	26	30		I
13:45	—	11,6	0,26	117	25	3,4	1,9	1,6	3,4	—	0,32	—	105	—	28	—	27	35		
14:45	—	11,0	0,26	116	25	3,3	1,9	1,6	3,4	—	0,32	—	106	—	28	—	27	35		
15:45	—	11,0	0,26	115	25	3,3	1,8	1,6	3,1	—	0,32	—	108	—	28	—	28	40		
[illegible]:45	—	11,2	0,26	115	25	3,2	1,8	1,65	3,1	—	0,32	—	108	21	28	35	29	40		II
			0,28		25															
17:45	—	12,1	0,26	116	25	3,1	1,8	1,7	3,1	—	0,31	—	106	—	28	36	—	45		II
18:45	—	12,2	0,26	117	25	3,1	1,8	1,7	3,0	—	0,34	—	107	—	32	37	—	50		II
19:45	—	12,2	0,26	118	25	3,1	1,8	1,75	3,0	—	0,34	—	106	—	30	36	—	50		II
20:45	—	12,3	0,26	118	25	3,3	1,8	1,80	3,1	—	0,35	—	106	—	31	35	—	150		II
21:45	—	12,3	0,28	118	25	3,5	2,0	1,90	3,3	—	0,37	—	106	—	31	35	—	40		II
22:45	—	12,4	0,28	117	25	3,6	2,1	1,95	3,5	—	0,37	—	106	—	3,2	34	—	40		II
			0,27		25															

PETROBRAS
SIX

U-45 BANCADA (PAINEL)

DATA: 13/12/88
T-OP: 2/3-1

I

HORA	VAZÕES (%) Gás de Recic. Quente	Gás de Recic. Frio	Gás p/ CS-4501	Gás do Rejeito	PRESSÕES (cm Hg) R-4501 Topo	Aquec	Pirólise	Pirólise	Pirólise	Restr.	Restr.	Sistema	CM-4501 Suc.	CM-4501 Desc.	AQ-4501 (GRO) Entrada	AQ-4501 (GRO) Saída	Gás Reciclo Frio	Gás Rejeito	OPERADOR	GRUPO
	FRC 01	FRC 02	FR 03	FQ 04	PR 01	PR 02	PR 03	PR 04	PR 05	PR 06	PR 07	PRC 08	PRC 09	PR 10	PR 11	PR 12	PR 13	PR 14		
10:45	30	10	–	40860	0.37	0.69	3.85	3.41	4.08	3.96	3.96	0.22	-0.11	18.94	13.22	4.63	3.74	14.54	08	I
11:45	30	10	–	40890	0.37	1.16	4.08	3.30	4.30	4.26	4.26	0.22	-0.11	18.06	13.66	4.85	4.19	12.38	08	I
12:45	31	10	–	40939	0.37	1.91	4.30	3.96	4.63	4.55	4.70	0.22	-0,11	17.18	14:10	5,03	4.63	11.89	08	I
13:45	31	10	–	40984	0.37	2.06	4.41	4.03	4.74	4.70	4.70	0.22	-0,22	20.71	14.54	5,29	4.63	13.22	08	I
14:45	31	10	–	41015	0.32	1,98	4.30	4.08	4.63	4.55	4.55	0.22	-0,22	21.15	14.98	5,29	4.63	18.94	08	I
15:45	31	11	–	41054	0,22	1,98	4,30	4,08	4,74	4,70	4,70	0,22	-0,22	20,27	14,10	5,07	4,41	17,62		III
16:45	31	11	–	41089	0,24	1,98	4,41	3,96	4,63	4,41	4,41	0,22	-0,22	20,27	14,10	5,29	4,41	17,62		III
16:45	31	11	–	41099	0,29	1,98	4,41	3,86	4,63	4,41	4,41	0,22	-0,22	20,27	14,10	5,29	4,41	17,62		
17:45	31	10	–	41123	0,44	2,72	5,07	4,52	5,18	5,29	5,29	0,22	-0,22	14,98	14,98	8,37	5,29	16,74		
18:45	31	10	–	41154	0,59	3,89	4,96	4,41	4,52	5,14	5,14	0,11	-0,44	22,03	13,22	6,17	5,79	20,27		
P.213.1	30,71	10,29		228	0,34	1,91	4,23	3,90	4,53	4,44	4,46	0,22	-0,17	19,51			4,37	15,23		

PETROBRAS
SIX

U-45 BANCADA (PAINEL E ALINHAMENTO DOS PRODUTOS)

DATA: 13/12/88
T-OP: 213-1

2

	TIR-1 (°C)					P-4501				MO 4501	MD-4501		CM 4501	OPERADOR	GRUPO
	CM-4501		GRQ Antes AQ	GÁS Reciclo Frio	GÁS Rejeito	PRIMÁRIO		SECUNDÁRIO		Kg	RPM	kg/h	%		
	SUC.	DESC.													
HORA	TR 12 (2)	TR 13 (3)	TR 14 (4)	TR 17 (5)	TR 19		Volt	m.Amp.	k.Volt	WI 01	SIC 01	Xisto	SIC 02		
10:45	150	130	155	120	45		380	8	40	1517	140.		80	01.	I
11:45	135	115	170	130	35		380	8	41	1464	180	53	80	02	I
12:45	130.	110	120.	140	35		380	9	41	1401	180	63	30	01	I
13 45	130	120	150	120	30		380	3	41	1330	160	71	85	02	I
14:45	130	120	150	110	30		380	8	41	1270	170	60	85	01.	I
15 45	120	120	150	100	30		380	8	41	1209	160	61	85	〃	III
16.45	130	120	170	100	30		280	8a	41	1146	160	03	85		III
16.45	130	120	170	100	30		380	8	41	1146	160	63	85		
17:45	130	120	170	100	30		380	8	41	1078	160	68	85		
18:45	130	120	160	100	30		390	9	41	1026.	80	52	85		
				117	33,5					371		61,8			

OBS.:

PETROBRAS
SIX

U-45 BANCADA (PAINEL)

DATA: 13/12/85
T-OP: 213-1

3

TjR-2 (°C)

	Saída de [illegible]	R-4501								6 FT		7 FT		AQ-4501		10 FT		AQ-4501		Cupl AQ e F.F.	Cais pl. [illegible]	OPERADOR
		Topo	Secag.	Aquec.	Finalisaç.			Resfriamento		N	S	N	S	Câmara	G.R.Q.	N	S	Pele do Tubo				
HORA	TR 10	TR 09	TR 01	TR 02	TR 03	TR 04	TR 05	TR 06	TR 07	TR 08	TR 25	TR 26A	TR 26B	TR 15	TR 16	TR 27A	TR 27B	TR 20	TR 21	TR 23	TR 24	
10:45	205	210	350	415	440	460	475	465	385	180	505	–	–	540	505	–	–	530	325	205	100	01
11:45	205	215	345	410	425	455	490	465	425	240	495	–	–	555	500	–	–	525	320	205	100	01
12:45	200	215	325	405	415	460	500	490	445	285	515	–	–	565	520	–	–	545	330	205	100	01
13:45	200	210	335	405	425	505	490	490	455	325	480	–	–	435	450	–	–	465	250	200	100	01
14:45	200	205	330	410	435	460	500	460	460	345	515	–	–	540	510	–	–	435	325	200	100	01
15:45	205	210	350	415	430	470	505	480	465	340	505	–	–	530	500	–	–	530	320	205	100	[illegible]
16:45	200	205	350	415	430	460	505	475	470	340	515	–	–	530	510	–	–	535	330	205	100	[illegible]
16:45	200	205	350	415	430	460	505	475	470	370	515	–	–	530	510	–	–	535	330	205	100	
17:45	205	185	365	415	430	465	495	415	470	390	510	–	–	540	505	–	–	530	330	205	100	
18:45	210	215	370	415	430	465	505	475	470	385	520	–	–	540	610	–	–	535	340	205	100	
x̄	202	214	340	410	428	467	498			395	504									203		

PETROBRAS
PETRÓLEO BRASILEIRO S.A.
SIX

U-45 BANCADA (ÁREA).

DATA: 13/12/83

T-OP: 2/3

HORA	AQ-4501	AQ-4501	GÁS DE	P-4501	P-4501	CM-4502 ÓLEO DE SELAGEM	CM-4502 ÓLEO DE SELAGEM	CM-4502 ÓLEO DE SELAGEM	CM-4502 ÓLEO DE SELAGEM	MO	GÁS P/	V-4501	V-4501	V-4502	V-4502	V-4503	V-4503	THI	OPERADOR
	Chaminé	Óleo Combustível	RECICLO	GÁS	Vapor de Cortina	Descarga da Bomba	Após Filtro	Retorno Óleo	Após Filtro	4501	CS-4501	A	B	A	B	A	B		
	Thl 07	Pgl 01	Pgl 06	Thl 12	FI 08	Pgl 07	Pgl 09	Pgl 10	Pgl 13	Thl 01	Pgl 05	Thl 03	Thl 04	Thl 05	Thl 06	Thl 08	Thl 09	02	
10:45		14,4	0,22	119	25	3,3	1,7	1,7			0,27		110	23	28	29	29		
11:45	—	13,0	0,20	120	25	3,2	1,7	1,6	3,1	—	0,25	—	108	—	30	—	31	30	
12:45	—	13,4	0,20	118	25	3,2	1,7	1,6	3,0	—	0,24	—	109	—	32	—	31	35	
13:45	—	12,0	0,24	118	25	3,8	2,2	1,9	3,6	—	0,30	—	106	—	33	—	31	35	
14:45	-	9,5	0,24	118	25	3,5	2,1	1,6		-	0,30	-	108	—	32	-	31	35	
15:45	-	8,0	0,24	116	25	3,8	2,2	1,9	3,7	-	0,32	-	106	-	32	-	30	35	
16:45		8,2	0,24	117	25	3,6	2,1	1,8	3,5	-	0,30	-	106	-	32	-	30	38	
16:45		8,2	0,24	117	25	3,6	2,1	1,8	3,5	-	0,30	-	106	-	32	-	30	38	
17:45		8,2	0,23	117	25	3,6	2,1	2,0	3,5	-	0,30	-	106	-	30	30	30	40	
18:45		8,1	0,24	117	25	3,1	1,5	1,6	3,0	-	0,35	-	106	-	28	30		40	
			0,23																

PETROBRAS
SIX

U-45 BANCADA (PAINEL)

DATA: 14/12/88
T-OP: 213.2e 213.3

1

HORA	VAZÕES (%)				PRESSÕES (cm Hg)														OPERADOR	GRUPO
	GÁS DE RECIC.		Gás p/ CS-4501	Gás de Rejeito	R - 4501							Sistema	CM - 4501		AO-4501 (GRQ)		Gás Reciclo Frio	Gás Rejeito		
	Quente	Frio			Topo	Aquec.	Pirólise			Restr.			Suc.	Desc.	Entrada	Saída				
	FRC 01	FRC 02	FR 03	FQ 04	PR 01	PR 02	PR 03	PR 04	PR 05	PR 06	PR 07	PRC 08	PRC 09	PR 10	PR 11	PR 12	PR 13	PR 14		
2045	32	10	32	2140	0,37	1,69	3,74	3,19	3,74	3,67	3,67	0,22	-0,11	17,62	13,66	4,41	3,74	14,98		
:45	32	10	—	2176	0,37	1,84	3,63	2,97	3,85	3,82	3,82	0,22	-0,11	17,18	13,66	4,63	3,74	14,93		
:45	38	9	—	2209	0,37	2,42	4,85	4,08	5,08	4,99	4,99	0,22	-0,33	21,59	18,06	5,73	4,85	13,50		
:45	39	10	-	2249	0,37	2,57	4,85	4,41	5,29	5,43	5,43	0,22	-0,44	22,91	18,50	5,95	5,07	19,22		
:45	39	11	—	2289	0,37	2,50	5,07	4,41	5,40	6,43	5,43	0,22	-0,55	22,91	18,94	6,17	5,29	19,82		
:45	39	11	—	2329	0,37	2,57	5,18	4,63	5,51	5,58	5,58	0,22	-0,66	23,35	19,38	6,39	5,51	20,27		
:45	38	10	-	2372	0,37	2,57	5,07	4,52	5,29	5,29	5,29	0,22	-0,55	24,23	18,94	6,17	5,29	21,59		
	3[illegible],71	10,14		232	0,31	2,30	4,62	4,03	4,87	4,89	4,88	0,22	-0,39	21,40				18,56		
1:45	38	10	—	2312	0,37	2,51	5,07	4,52	5,29	5,29	5,29	0,22	-0,55	24,23	18,94	6,17	5,29	21,59		
.45	36	10	—	2414	0,37	2,72	5,07	4,52	5,29	5,29	5,29	0,22	-0,55	24,61	18,50	6,17	5,29	21,29		
:45	33	10	—	2449	0,51	3,01	5,18	4,52	5,40	5,43	5,43	0,22	-0,77	24,61	16,74	6,17	5,29	22,03		
:45	32	10	—	2492	0,59	3,52	5,51	4,85	5,29	5,58	5,58	0,22	-1,98	22,03	15,85	6,39	5,73	21,15		
:45	32	11	—	2523	0,73	4,26	6,39	5,51	4,95	6,02	6,02	0,22	-1,54	24,23	16,74	6,39	5,73	20,27		
:45	32	11	—	2569	0,59	3,89	5,62	5,07	6,17	6,17	6,17	0,22	-2,20	22,03	15,86	6,17	5,51	19,50		
	33,83	10,33	-	197	0,53	3,33	5,47	4,83	5,40	5,63	5,63	0,22	-1,26	23,64				20,86		

PETROBRAS
SIX

U-45 BANCADA (PAINEL E ALINHAMENTO DOS PRODUTOS)

DATA: 14/12/84
T-CP: 213.2/3

2

	TjR-1 (°C)					P-4501				MO 4501	MD-4501		CM 4501		
	CM-4501		GRO Antes 20	GÁS Reciclo Frio	GÁS Rejeito	PRIMÁRIO		SECUNDÁRIO		Kg	RPM	kg/h	%	OPERADOR	GRUPO
	SUC.	DESC.													
HORA	TR 12 ²	TR 13 ³	TR 14 ⁴	TR 17 ⁵	TR 19		Volt	m.Amp.	k.Volt	WI 01	SIC 01	Xisto	SIC 02		
22:45	130	125	130	120	40		410	11	44	800	80	60	75		
23:45	145	120	180	115	35		400	10	42	745	160	55	75		
00:45	150	155	180	120	45		440	9	42	686	180	59	12,5		
01:45	165	110	205	150	40		440	9	42	616	190	70	100		
02:45	140	140	180	120	30		400	10	43	543	190	73	100		
03:45	140	145	150	115	30		400	10	42	412	200	71	100		
04:45	135	145	130	120	33		400	10	42	398	190	71	100		
				122	33					403		67			
04:45	135	145	180	120	25		400	10	42	353	190	74	100		
05:45	135	145	185	135	28		400	10	42	321	180	77	91,5		
06:45	135	145	180	120	28		400	10	42	241	160	74	91,5		
07:45	135	145	180	130	28		400	10	42	181	150	66	95,0		
08:45	135	145	180	130	30		380	10	41	110	150	71	95,0		
09:45	135	145	180	125	30		380	10	41	044	150	66	95		
				125,5	28,7					354		71,3			

OBS.:-

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PETROBRAS
SIX

U-45 BANCADA (PAINEL)

DATA: 14/12/93
T-OP: 213.0/3

3

TJR-2 (°C)

HORA	Saída de Gases	R-4501								6 FT		8 FT		AQ-4501		10 FT		AQ-4501		Sup. Ar e F.F.	Gás Fl.	OPERADOR
		Topo	Secag.	Aquec.	Pirólise			Resfriamento		N	S	N	S	Câmara	G.R.G.	N	S	Pele do Tubo				
	TR 10	TR 09	TR 01	TR 02	TR 03	TR 04	TR 05	TR 06	TR 07	TR 08 25A	TR 25B	TR 26A	TR 26B	TR 15	TR 16	TR 22A	TR 27B	TR 20	TR 21	TR 23	TR 24	
22:45	210	240	345	420	455	470	485	455	310	150	510	-	-	540	500	495	-	530	340	205	100	
23:45	200	230	330	430	465	415	510	415	380	210	525	-	505	550	510	505	-	545	345	205	100	
00:45	205	245	360	435	460	410	505	480	425	265	510	-	-	540	505	500	-	525	330	205	100	
01:45	200	265	355	430	450	465	500	415	455	310	505		-	530	500	490		525	325	205	100	
02:45	205	240	350	420	445	460	495	410	465	345	505		-	535	500	490		525	325	205	100	
03:45	210	230	350	420	440	465	500	415	465	370	515	-	-	550	510	495	-	545	335	205	100	
04:45	200	215	340	420	445	475	505	480	465	390	520			550	515	505	-	540	335	205	100	
	200																					
	204	238	353	425	453	468	501			391	513									205	100	
04:45	200	215	340	420	445	475	505	480	465	390	520	-	-	550	515	505	-	550	335	205	100	
05:45	210	205	310	420	445	410	505	450	410	400	520	-	-	550	515	505	-	550	335	205	100	
06:45	210	200	355	415	445	410	505	480	415	410	520	-		555	520	505	-	550	330	205	105	
07:45	210	205	350	415	460	495	505	485	475	415	510	-	-	545	515	505	-	540	345	205	105	
08:45	200	210	350	425	465	495	505	485	475	420	510	-	-	545	510	505	-	540	345	205	105	
09:45	[illegible]	210	350	425	465	520	505	480	475	425	510	-	-	545	510	500	-	540	345	205	105	
	205	207,5	350,8	420	454	487	505			410	515	-	-							205	103	

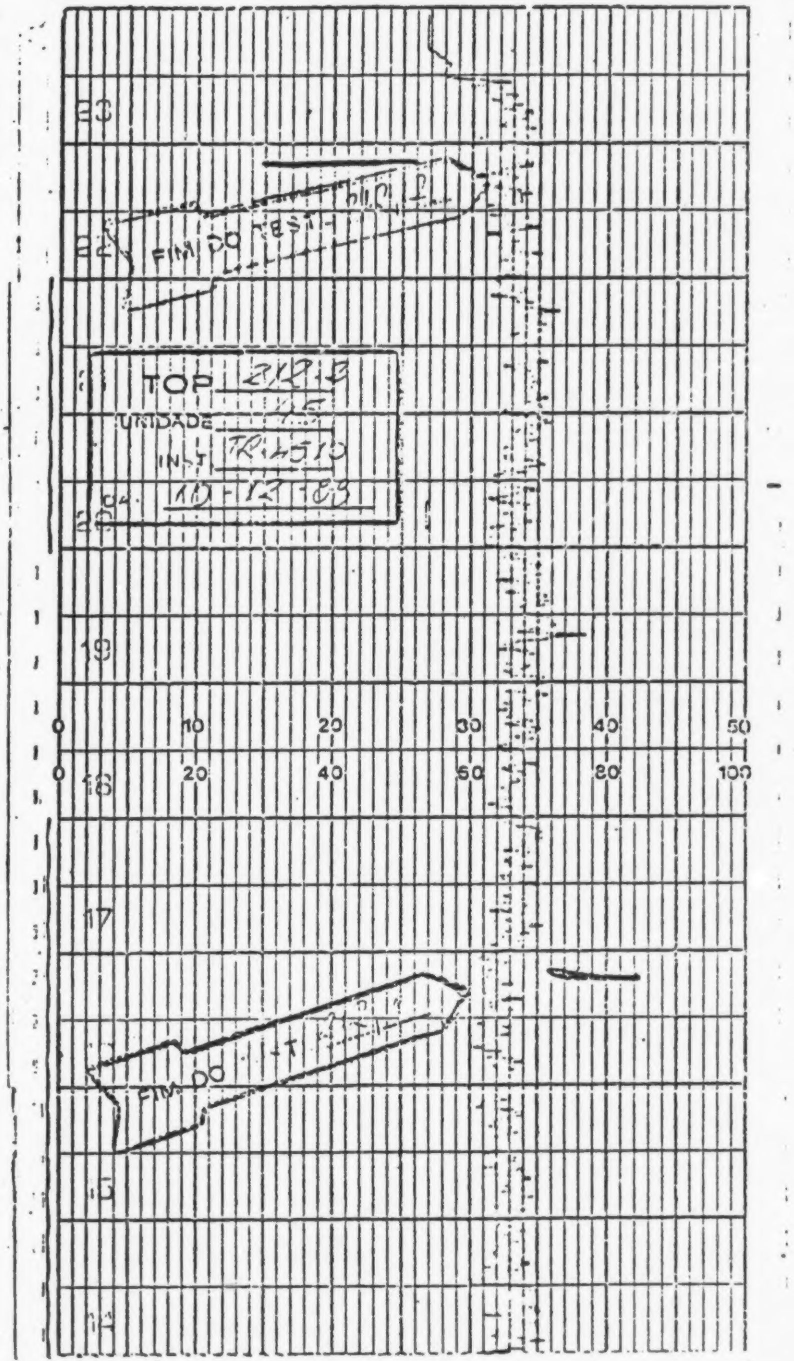
PETROBRAS
PETRÓLEO BRASILEIRO S.A.
SIX

U-45 BANCADA (ÁREA)

DATA: 14/12/88
T-OP: 213.2/3

4

HORA	AQ-4501 Chaminé	AQ-4501 Óleo Combustível	GÁS DE RECICLO	P-4501 GÁS	P-4501 Vapor de Cortina	CM-4502 Descarga da Bomba	ÓLEO DE SELAGEM Antes Filtro	ÓLEO DE SELAGEM Retorno Óleo	ÓLEO DE SELAGEM Após Filtro	MO 4501	GÁS P/ CS-4501	V-4501 A	V-4501 B	V-4502 A	V-4502 B	V-4503 A	V-4503 B	ST	OPERADOR	GRUPO
	Thi 07	Pgi 01	Pgi 06	Thi 12	FI 08	Pgi 07	Pgi 08	Pgi 10	[illegible]	Thi 01	Pgi 05	Thi 03	Thi 04	Thi 05	Thi 06	Thi 08	Thi 09	THI		
22:45	–	12,0	0,22	120	25	2,55	2,45	1,6	1,41	–	0,26	–	32	33	29	30	-	[illegible]		
23:45	–	12,1	0,18	122	25	2,55	2,4	1,6	1,45	–	0,25	–	62	–	28	–	27	25		II
00:45	–	11,8	0,22	120	25	2,55	2,4	1,6	1,4	–	0,30	–	74	–	27	–	27	25		II
1:45	–	11,8	0,21	122	25	2,5	2,3	1,6	1,3	–	0,32	–	79	–	30	–	27	35		II
2:45	–	12,0	0,25	119	25	2,5	2,3	1,6	1,3	–	0,31	–	86	–	31	–	27	35		II
3:45	–	13,2	0,25	123	25	2,45	2,3	1,6	1,3	–	0,31	–	76	–	31	–	27	35		II
4:45	–	13,6	0,26	125	25	2,45	2,2	1,6	1,2	–	0,33	–	92	–	30	27	27	40		II
							ANTES		APÓS											
			0,23		25		DO		O											
							FILTRO		FILTRO											
5:45	–	134	0,26	127	25	2,40	2,2	1,6	1,2	–	0,33	–	97	–	27	28	–	40		II
6:45	–	13,2	0,26	127	25	2,45	2,2	1,6	1,25	–	0,34	–	84	–	27	28	–	45		II
07:45	–	13,0	0,28	125	25	2,5	2,2	1,6	1,3	–	0,32	–	72	–	27	28	–	50		
08:45	–	13,0	0,26	124	25	2,5	2,3	1,6	1,3	–	0,32	–	66	–	28	28	–	40		
09:45	–	13,0	0,26	124	25	2,4	2,3	1,6	1,2	–	0,30	–	62	–	27	28	–	45		
			0,26		25															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FIM DO TESTE
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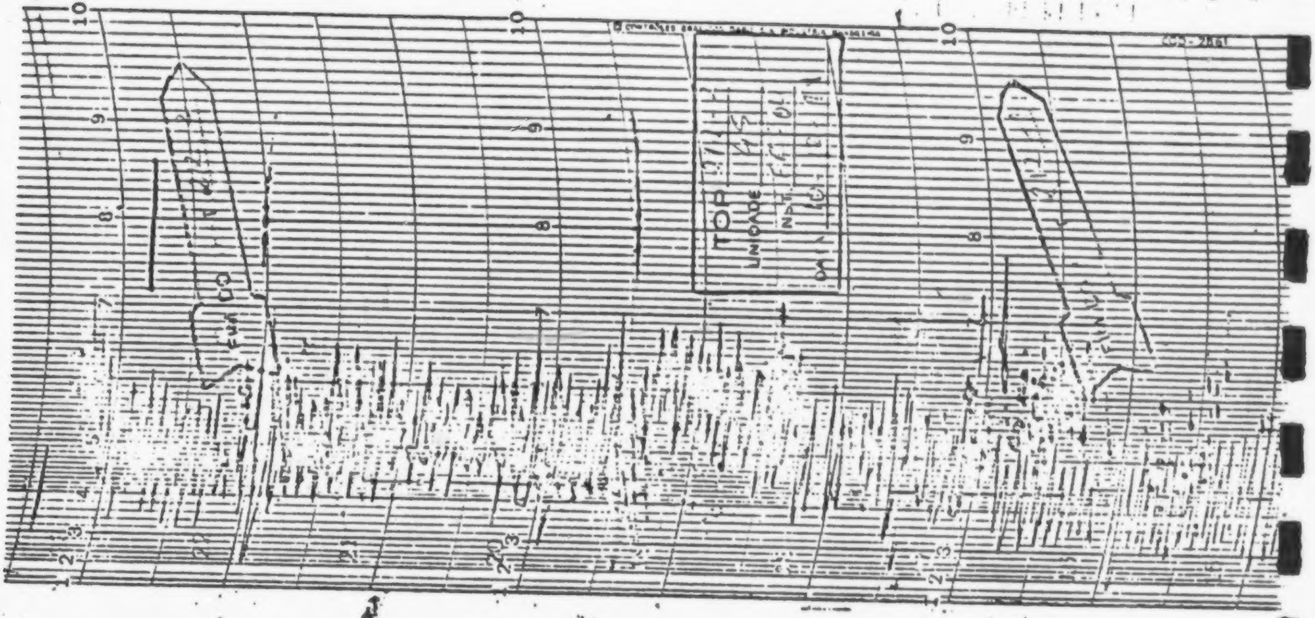
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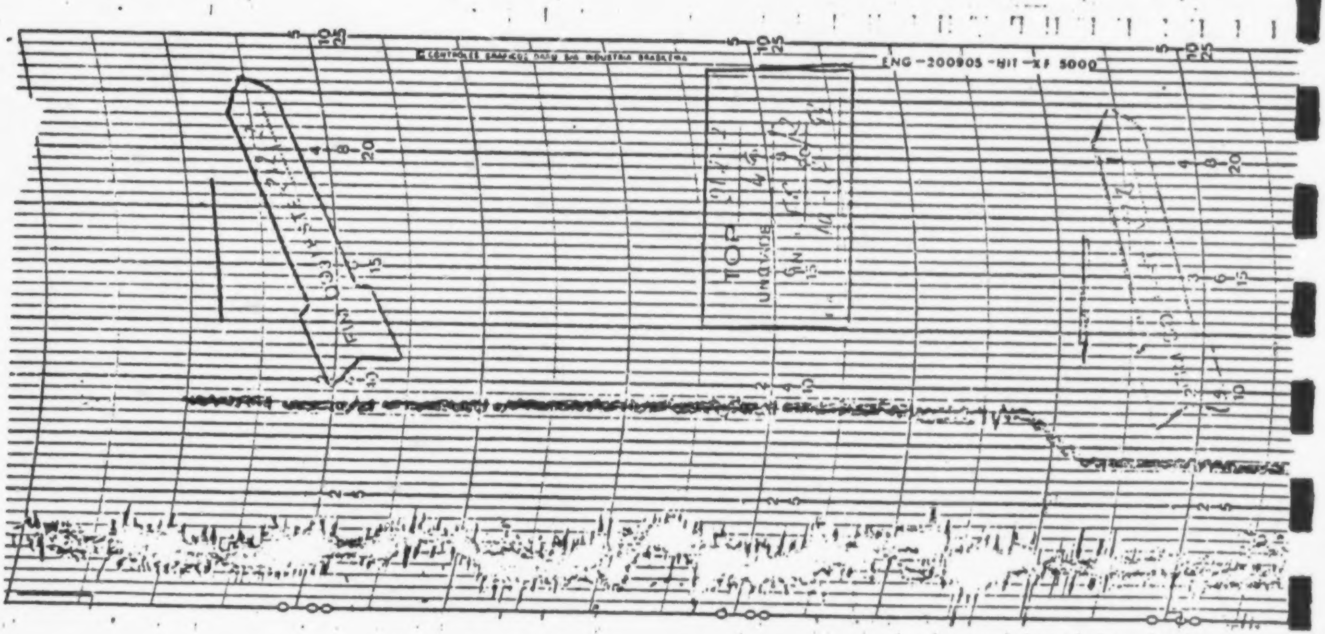
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ENG-200905-HIT-XF 5000
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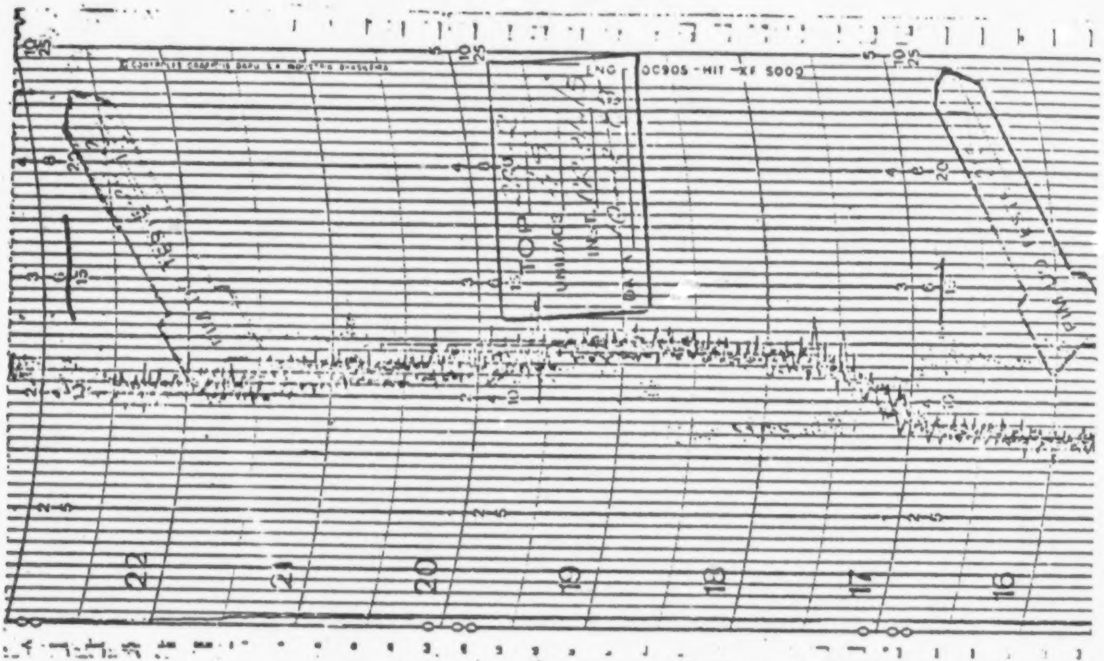
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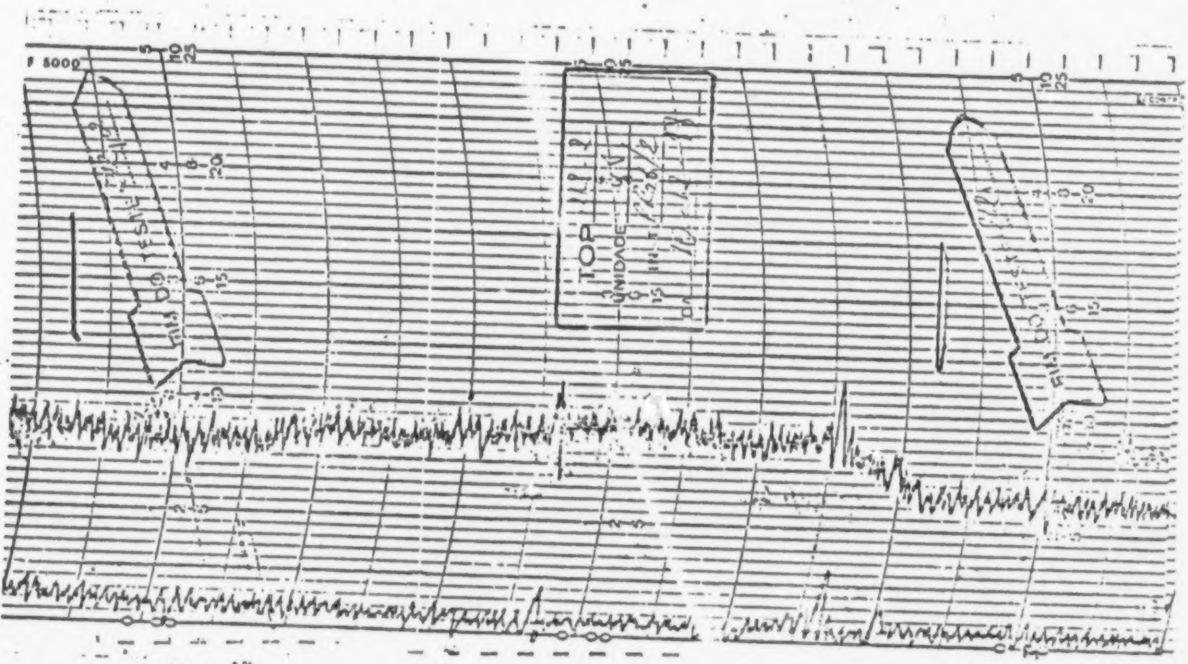
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TOP
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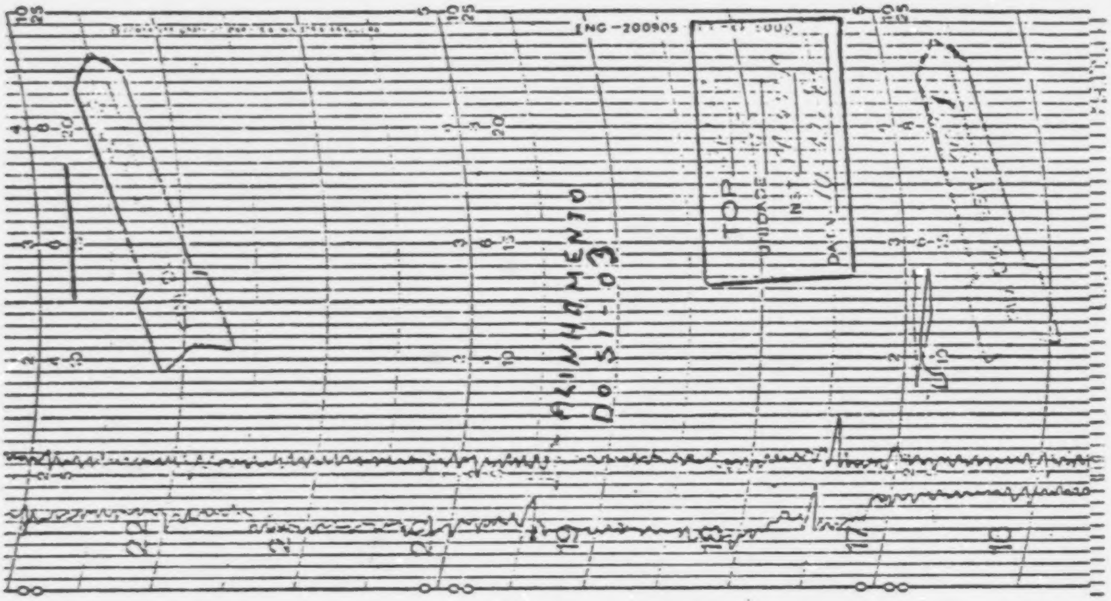
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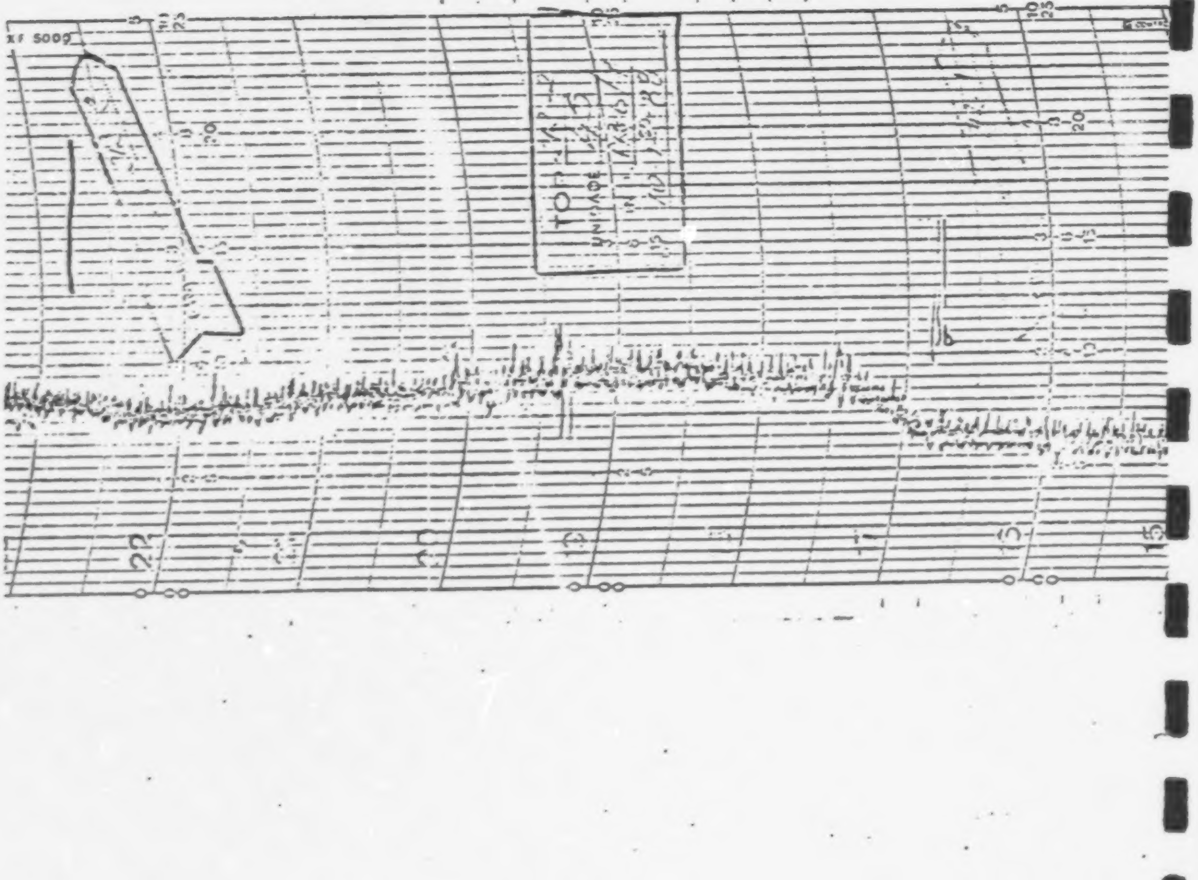
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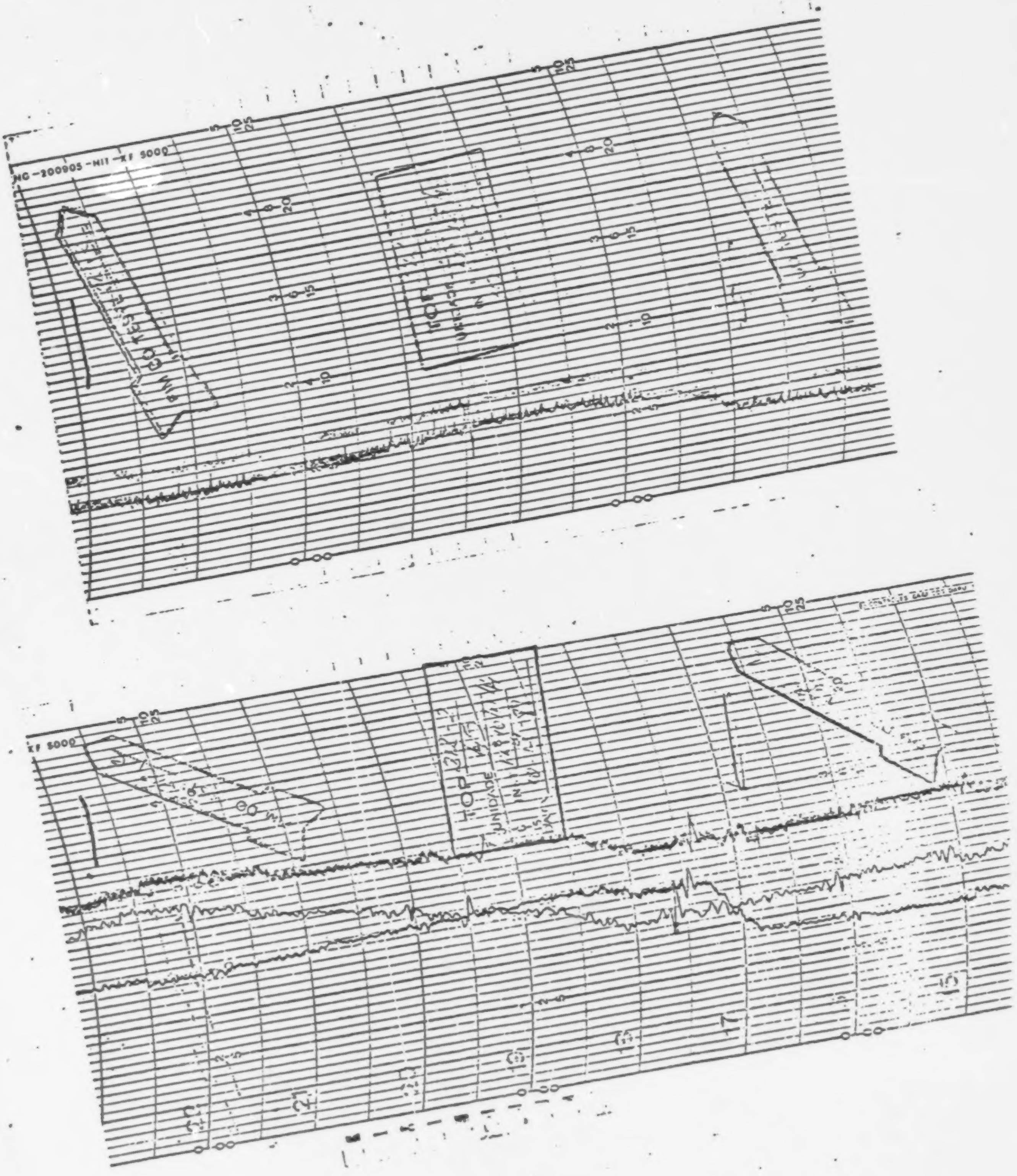

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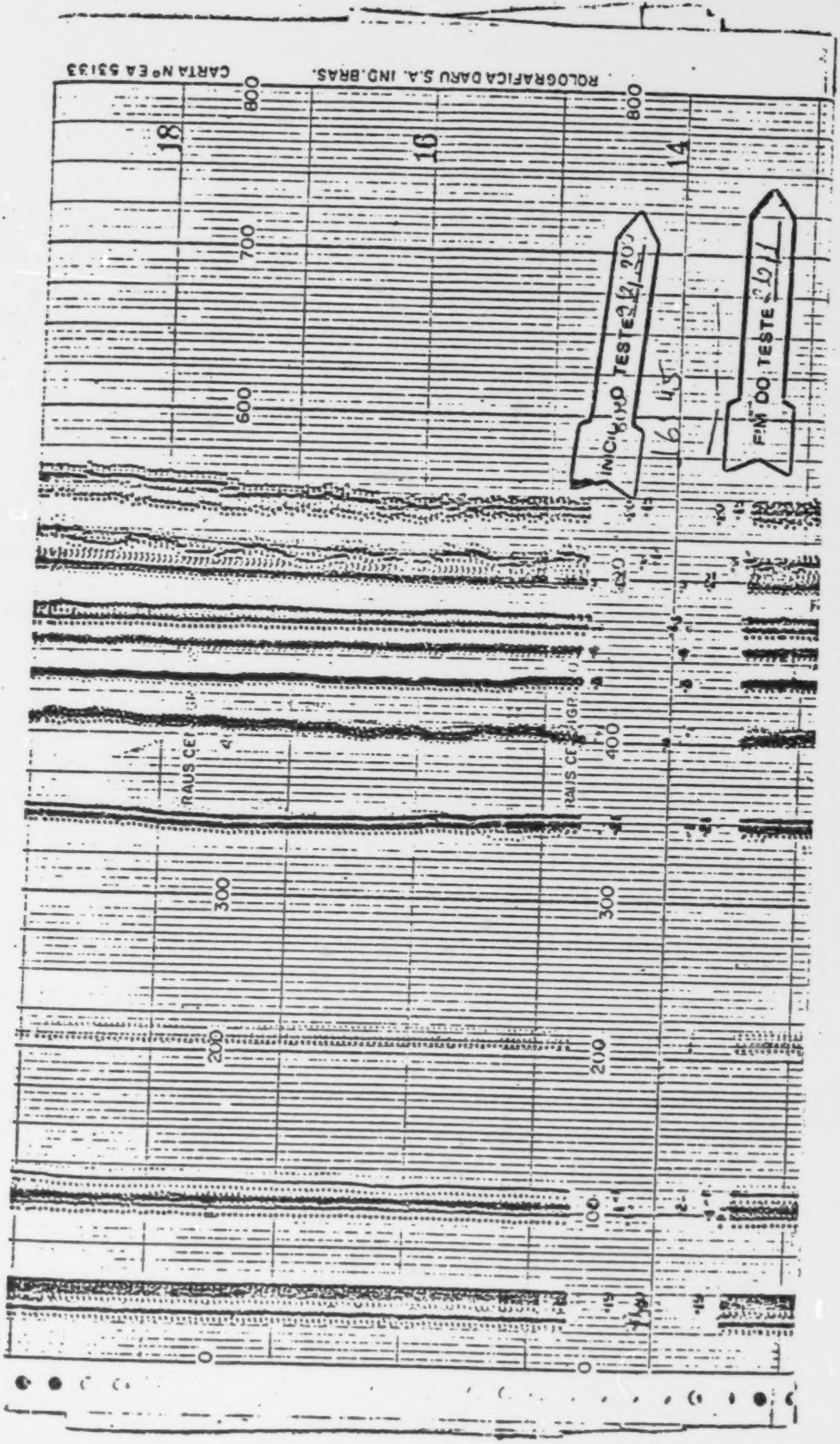
ROLOGRAFICA DARU S.A. IND. BRAS.
CARTA Nº EA 53133
INICIO DO TESTE
FIM DO TESTE
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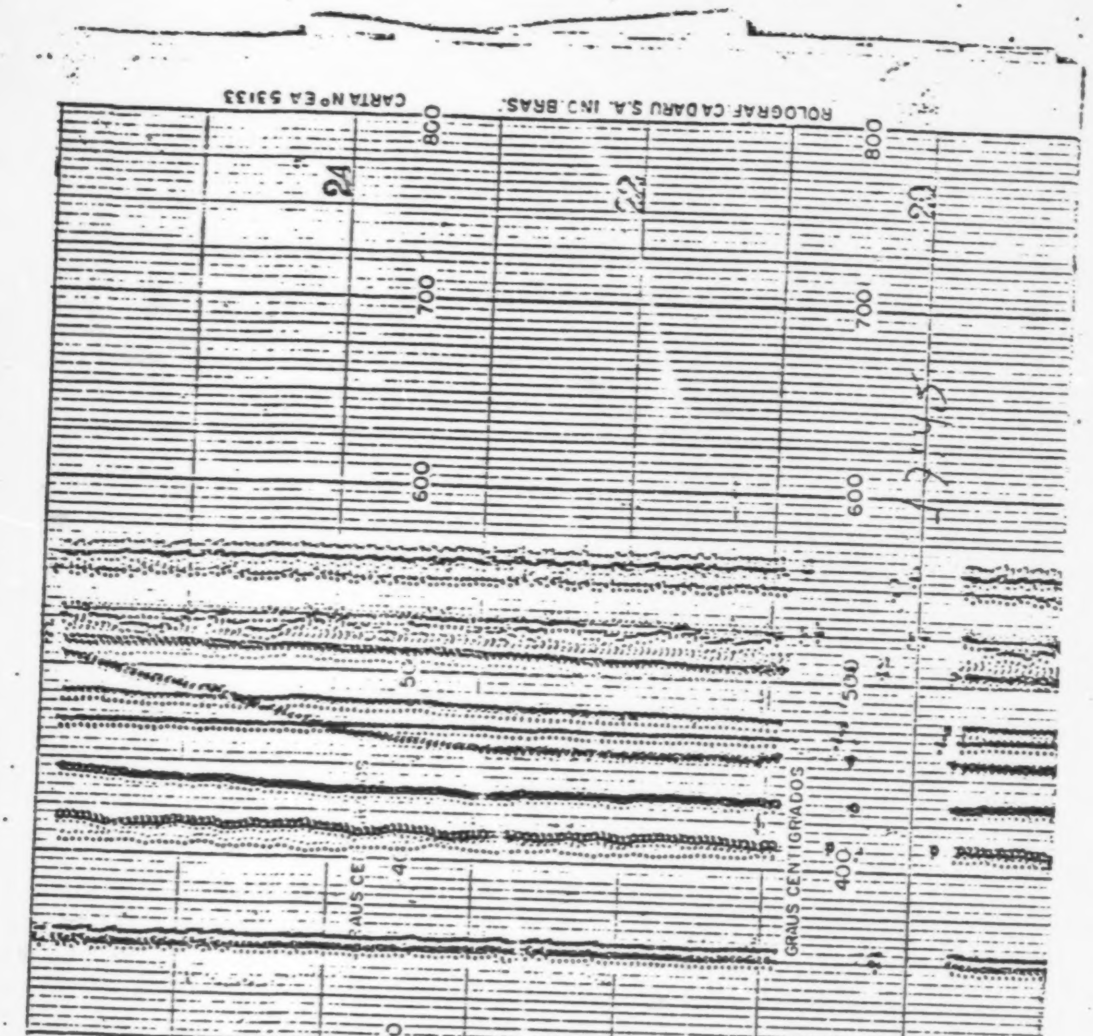
CARTA N° EA 53133
ROLOGRAF CADARU S.A. IND. BRAS.
GRAUS CENTIGRADOS
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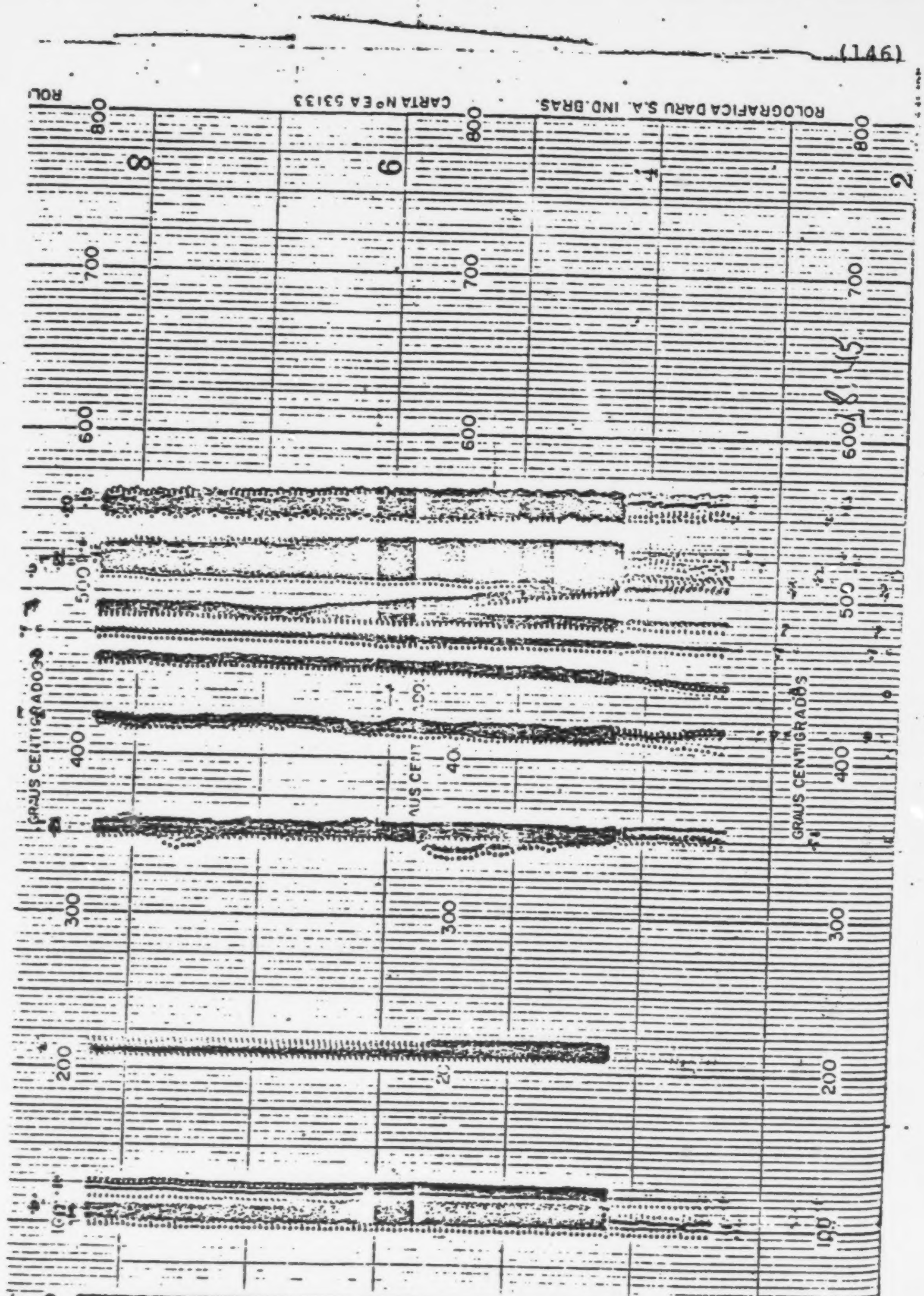
ROLOGRAFICA DARU S.A. IND. BRAS.
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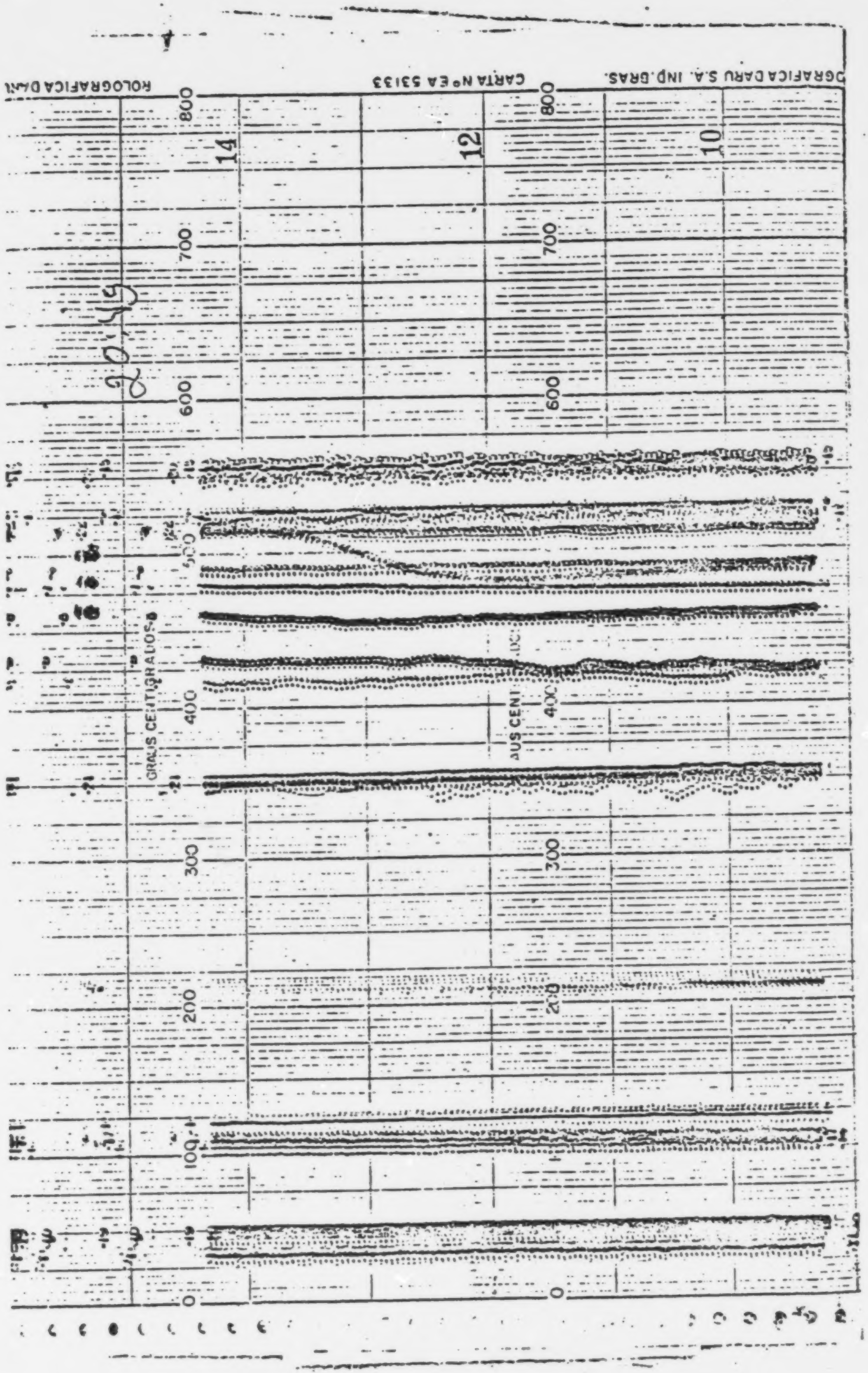

CARTA Nº EA 53133
GRAFICA DARU S.A. IND. BRAS.
GRAUS CENTIGRADOS
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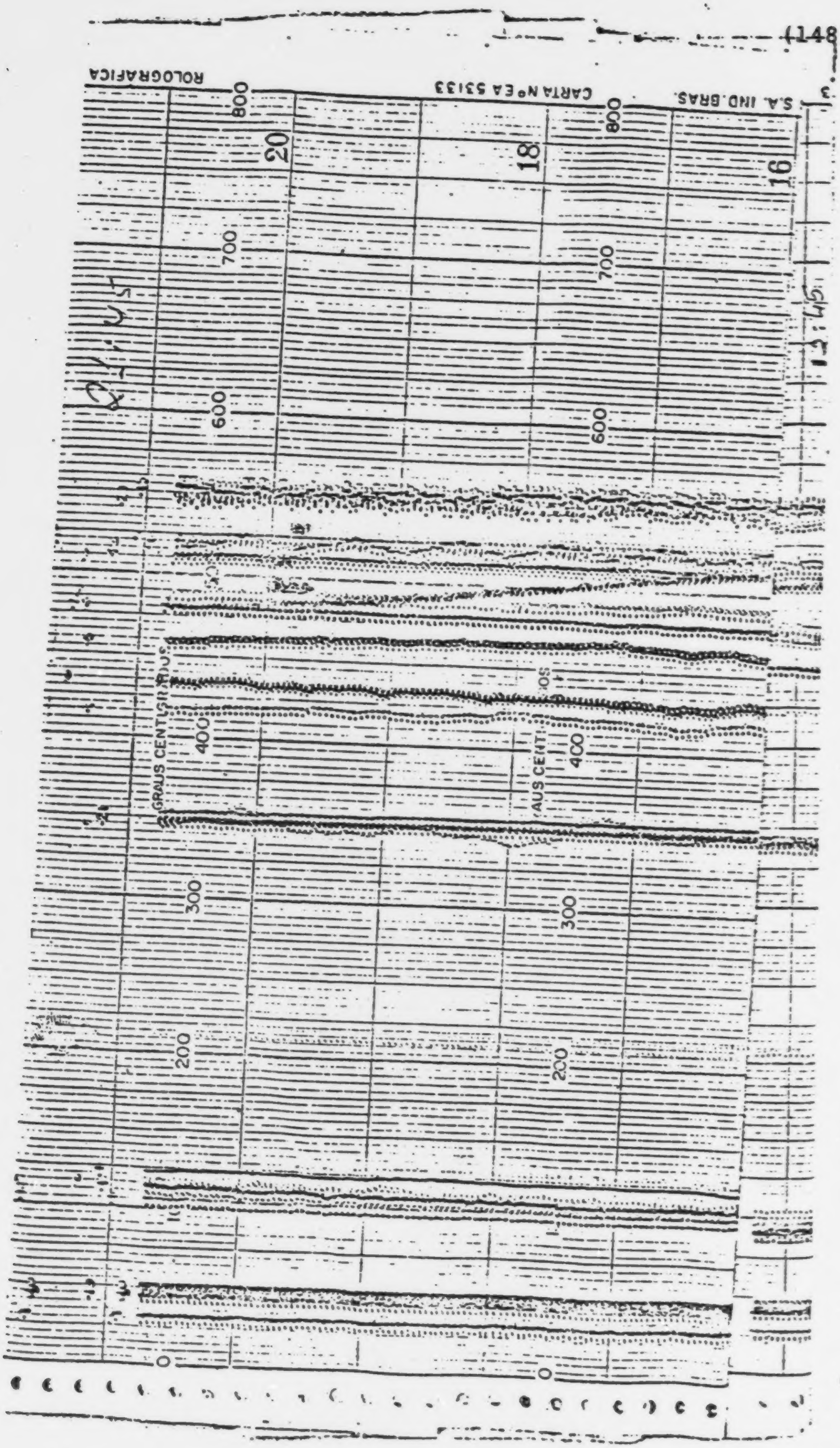
S.A. IND. BRAS.
CARTA Nº EA 53133
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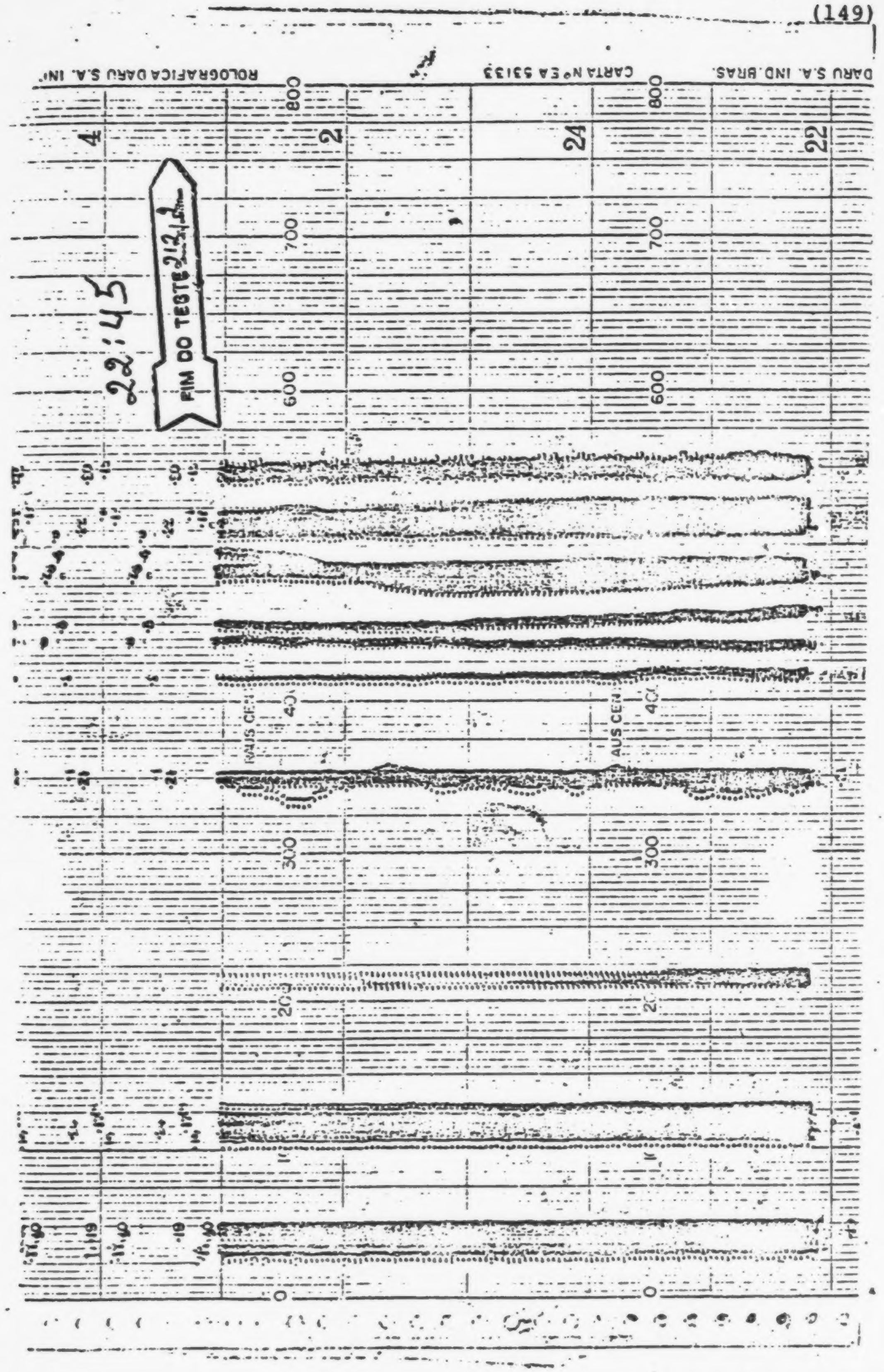
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CARTA Nº EA 53133
ROLOGRAFICA DARU S.A. IND.
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FIM DO TESTE 21/2
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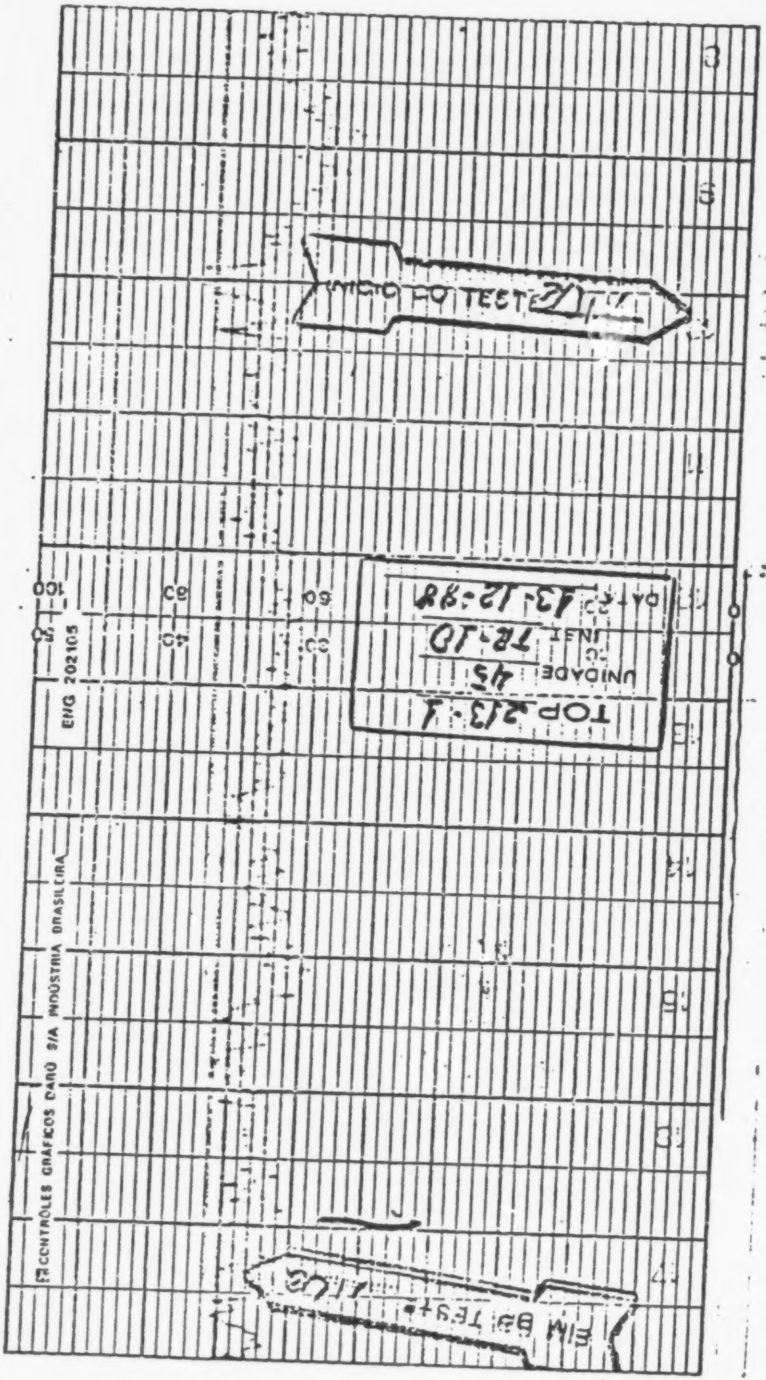
FIM DO TESTE 11:03
CONTRÔLES GRÁFICOS DARU S/A INDÚSTRIA BRASILEIRA
ENG 202105
TOP 213-1
UNIDADE 45
INST TR-10
DATA 13-12-88
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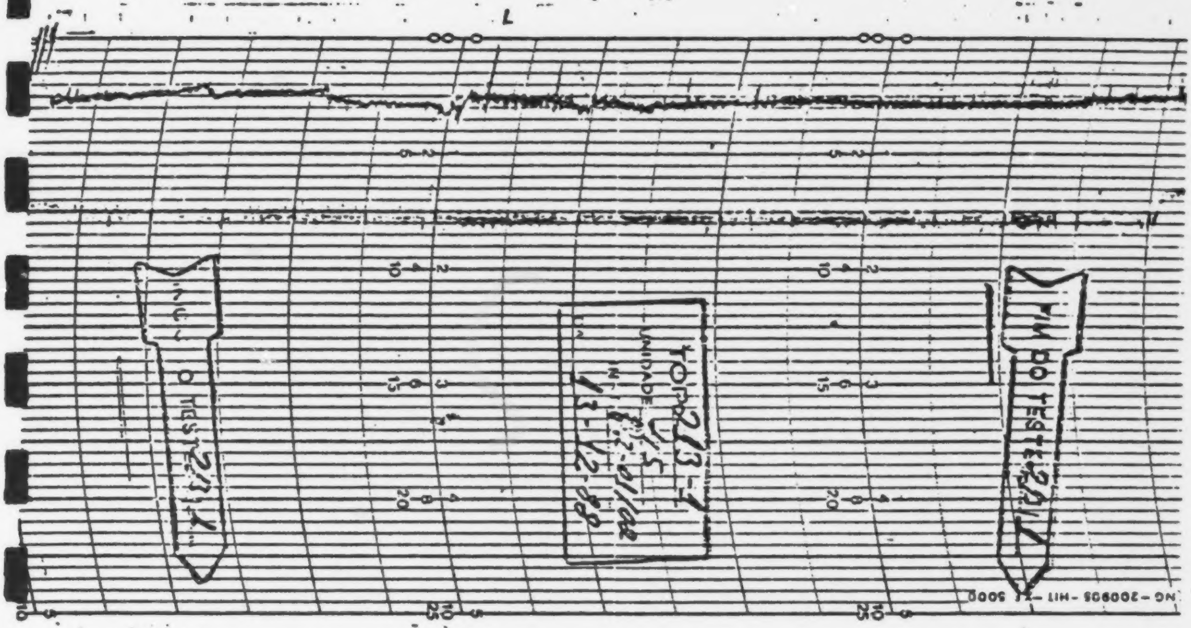
INICIO DO TESTE 8:10


INICIO DO TESTE 2/1/1
TOP213-1
UNIDADE U/S
N° 87-01/02
13-12-88
FIM DO TESTE 2/1/1
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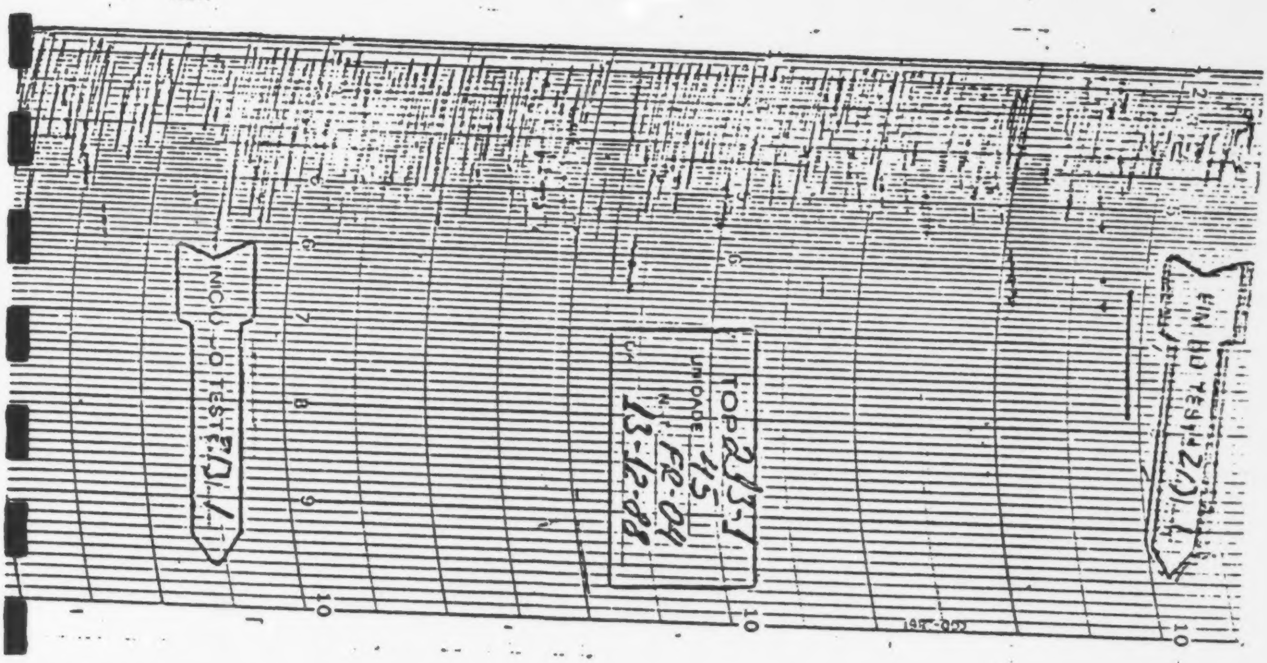
INICIO DO TESTE 2/1/1
TOP213-1
UNIDADE U/S
N° FR-04
13-12-88
FIM DO TESTE 2/1/1
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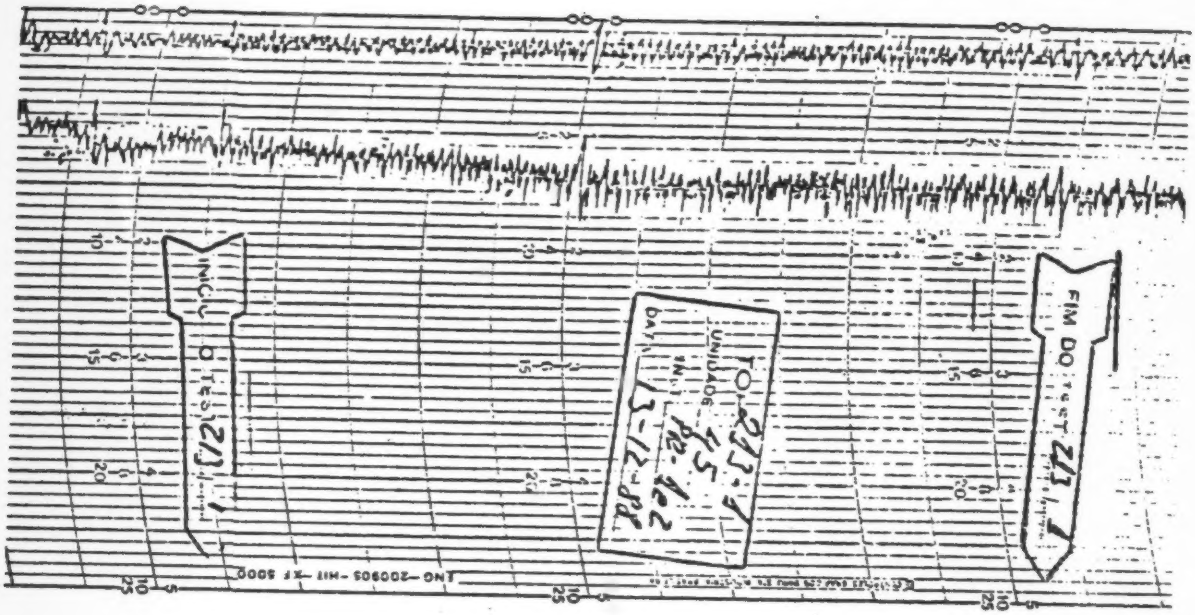
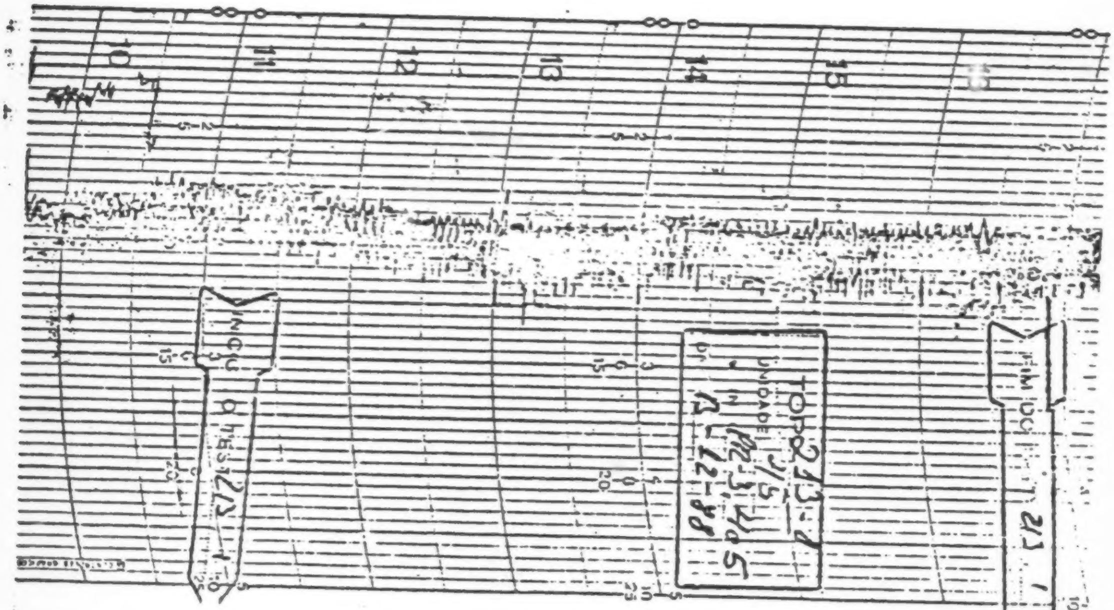

INICIO DO TESTE 213.1
TOP 213-1
UNIDADE 4/5
IN. PRE-1e2
DATA 13-12-88
FIM DO TESTE 213.1
ENG-200905-H11-XF 5000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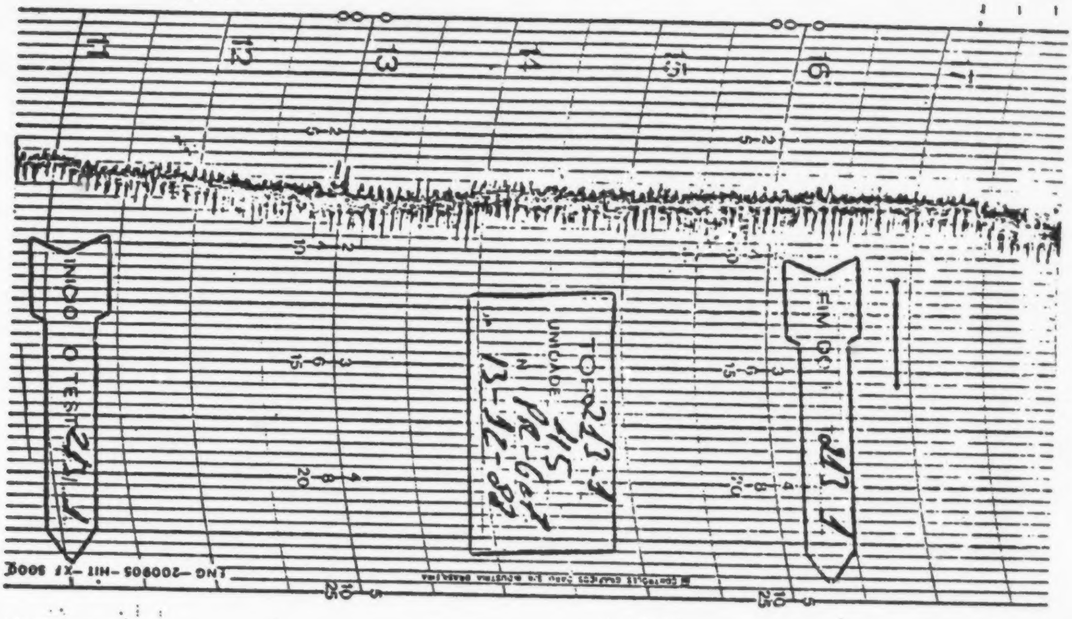
INICIO DO TESTE 213.1
TOP 213-1
UNIDADE 3/5
IN PRE-3,4 e 5
DATA 13-12-88
FIM DO TESTE 213 1


INICIO O TESTE 2A-1
FIM DO TESTE 2A-1
TOP 213-1
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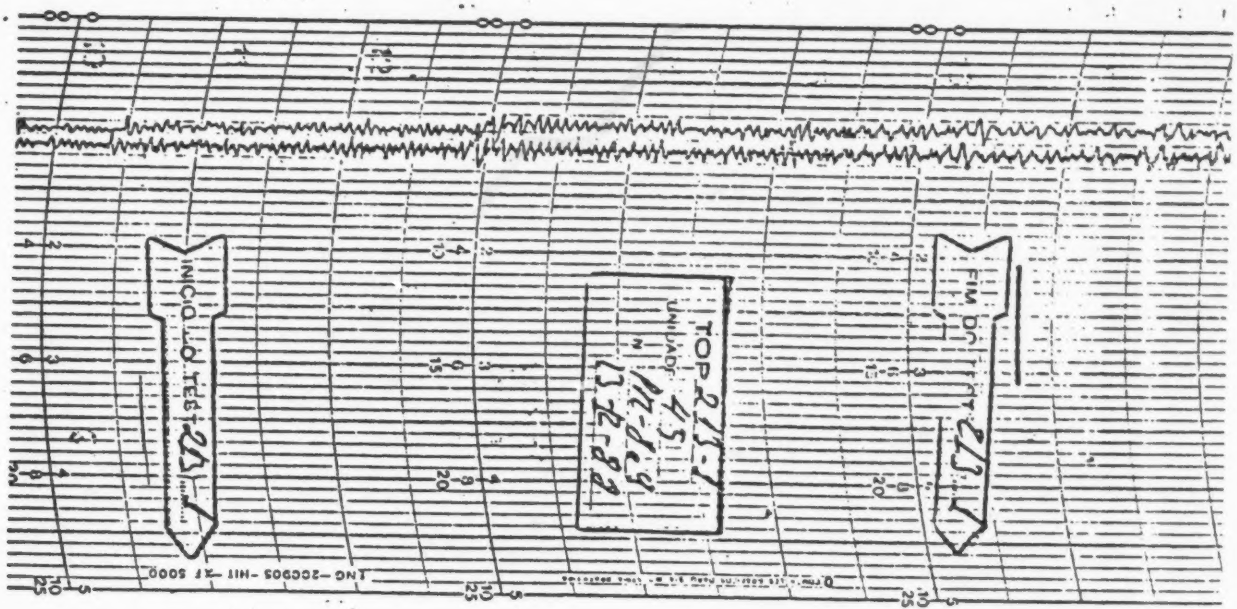
INICIO O TESTE 2A-1
FIM DO TESTE 2A-1
TOP 213-1
UNIDADE 45
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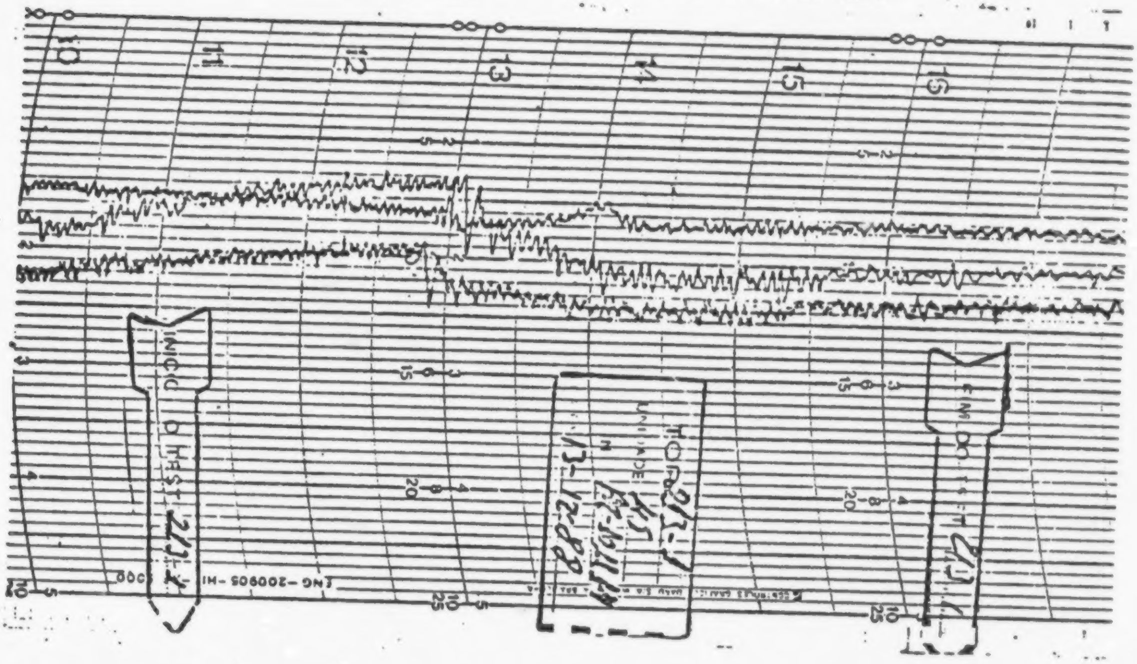
LNG-200905-HI1-XF 5000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INICIO DE TESTE 213-1
TOP 213-1
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FIM DO TESTE 213-1
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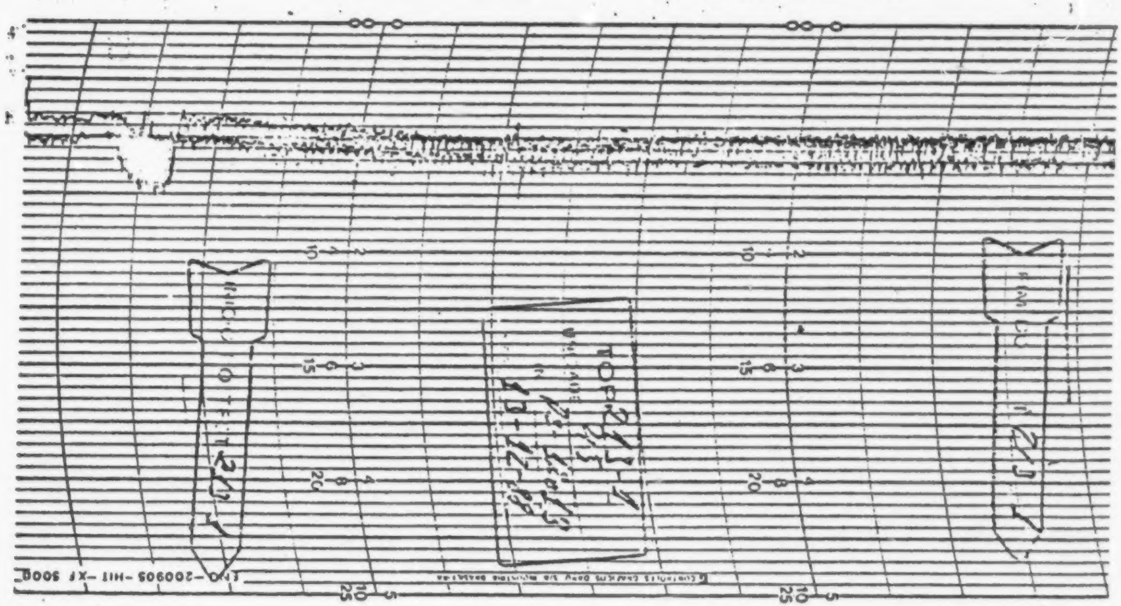
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TOP 213-1
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13-12-82
FIM DO TESTE 213-1
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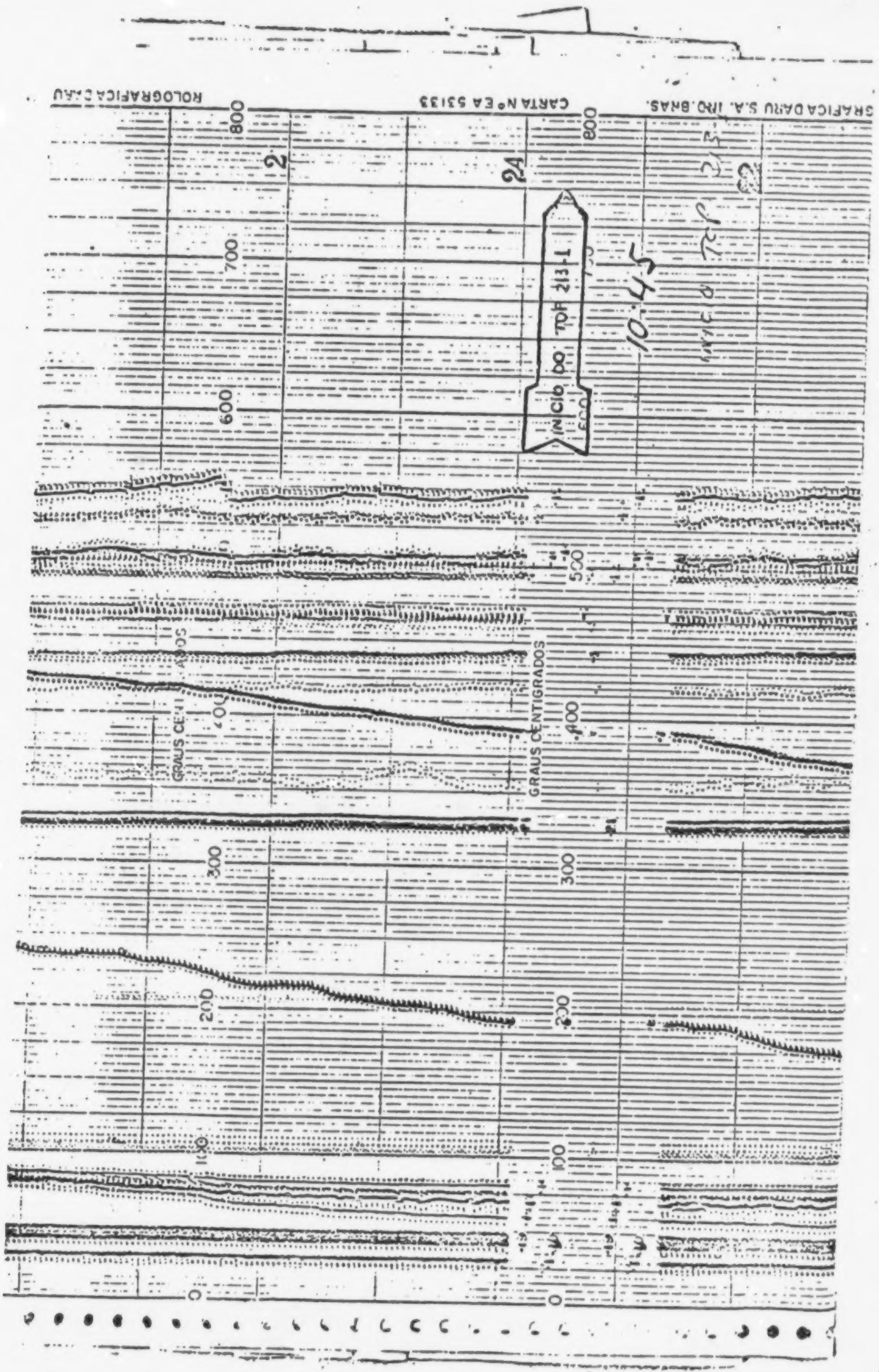
GRAFICA DARU S.A. IND. BRAS.
CARTA Nº EA 53133
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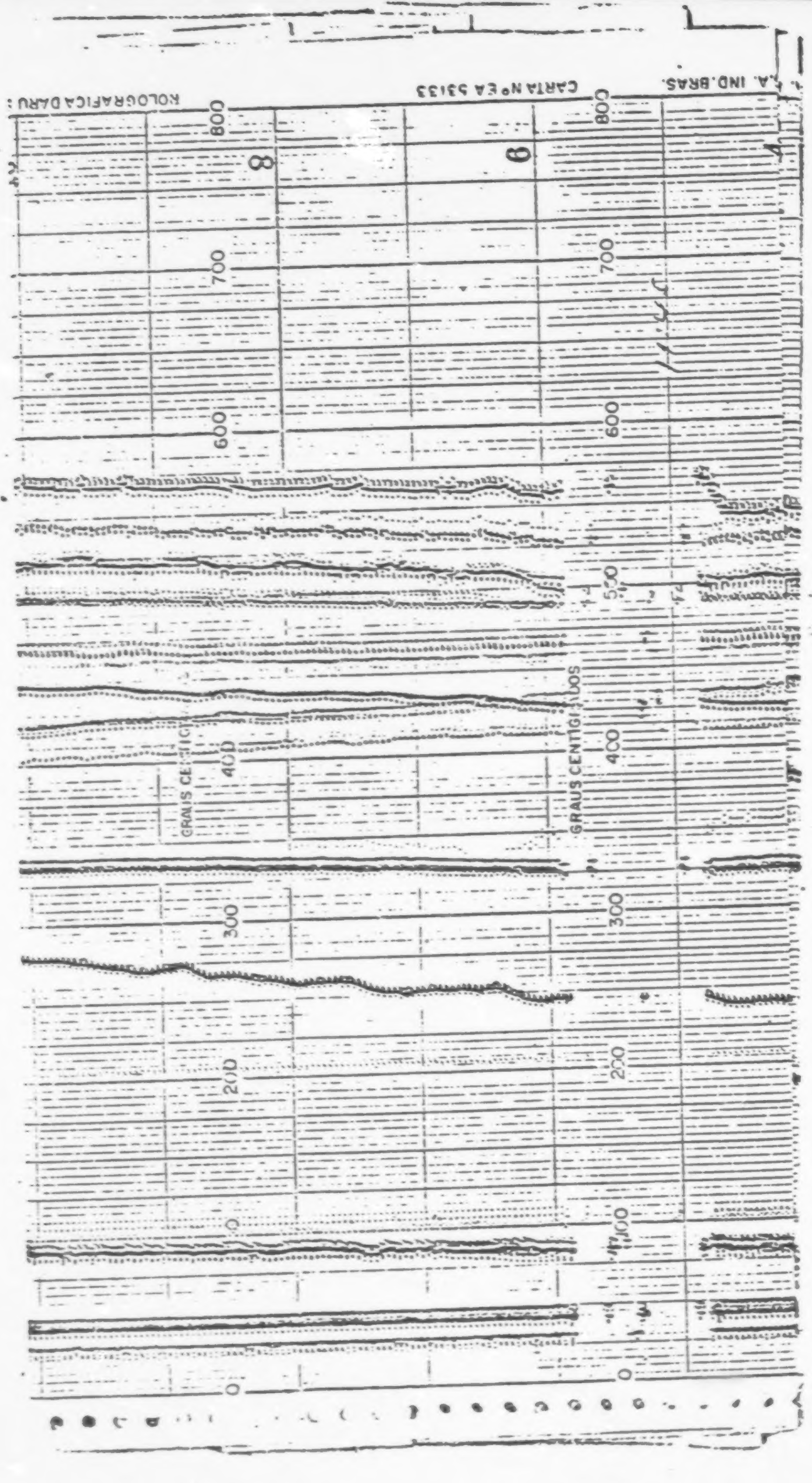
S.A. IND. BRAS.
CARTA Nº EA 53133
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GRAUS CENTIGRADOS
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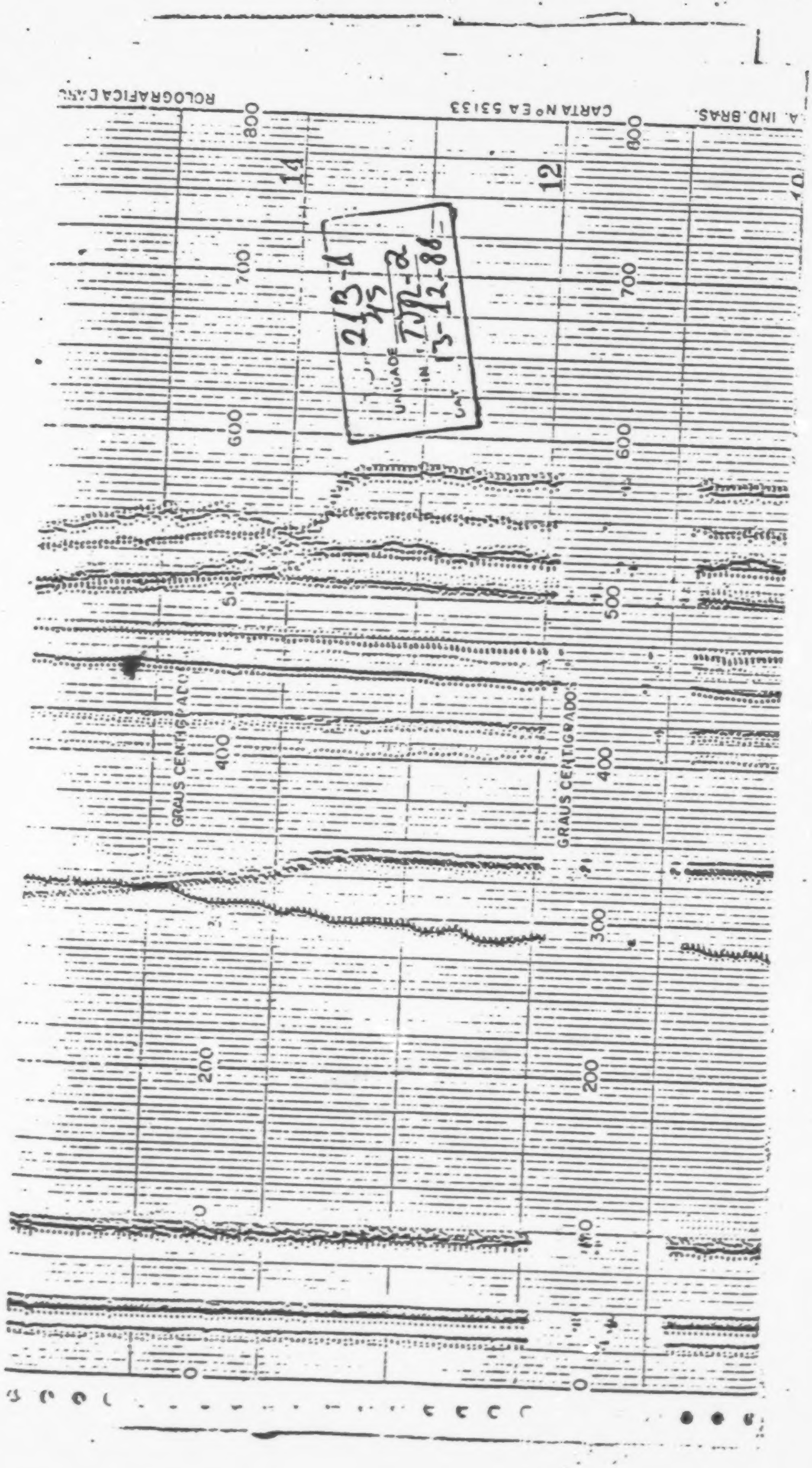
A. IND. BRAS.
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ROLOGRAFICA C.A.
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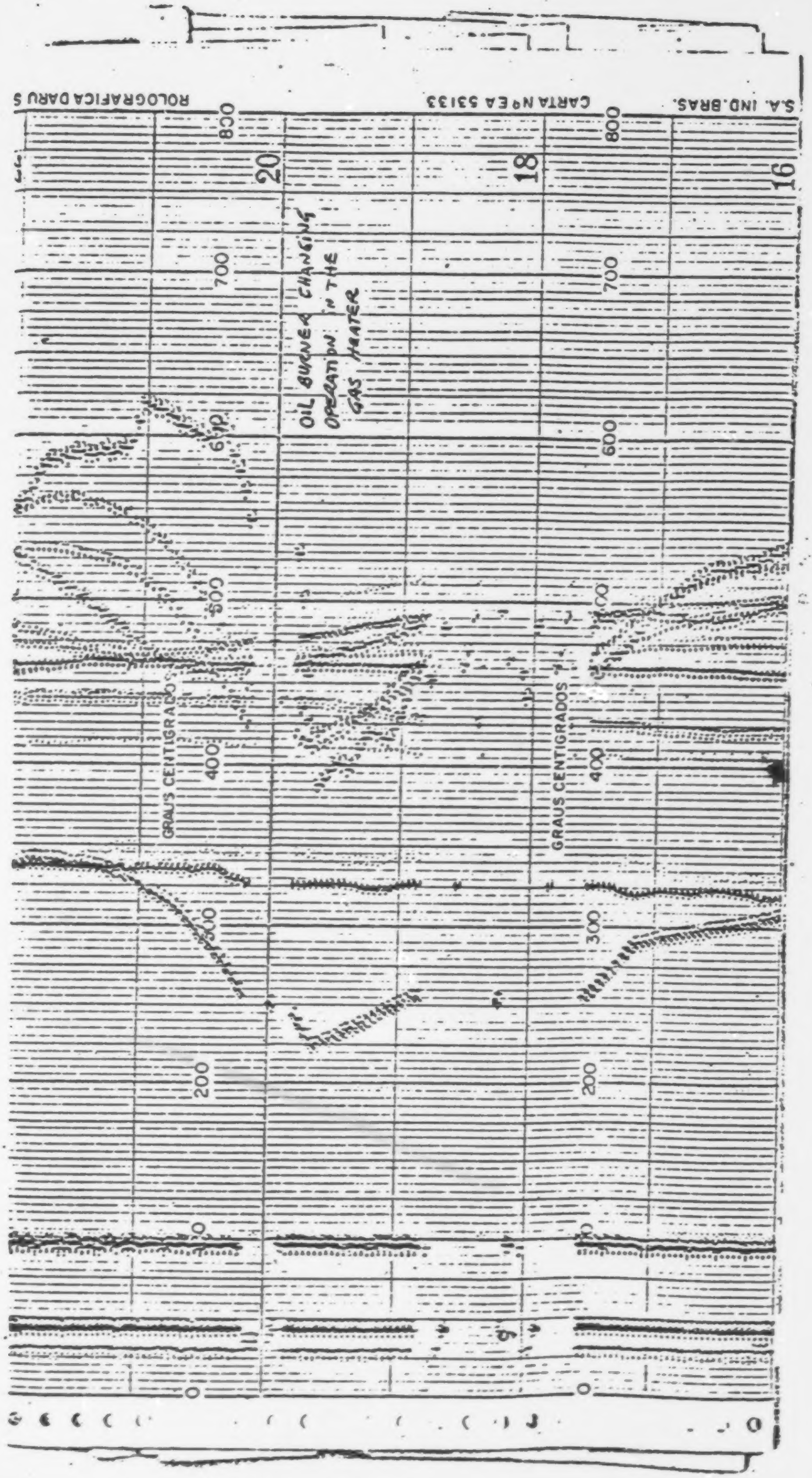
IN 13-12-88


S.A. IND. BRAS.
CARTA Nº EA 53133
ROLOGRAFICA DARU 5
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GRAUS CENTIGRADOS
GRAUS CENTIGRADOS
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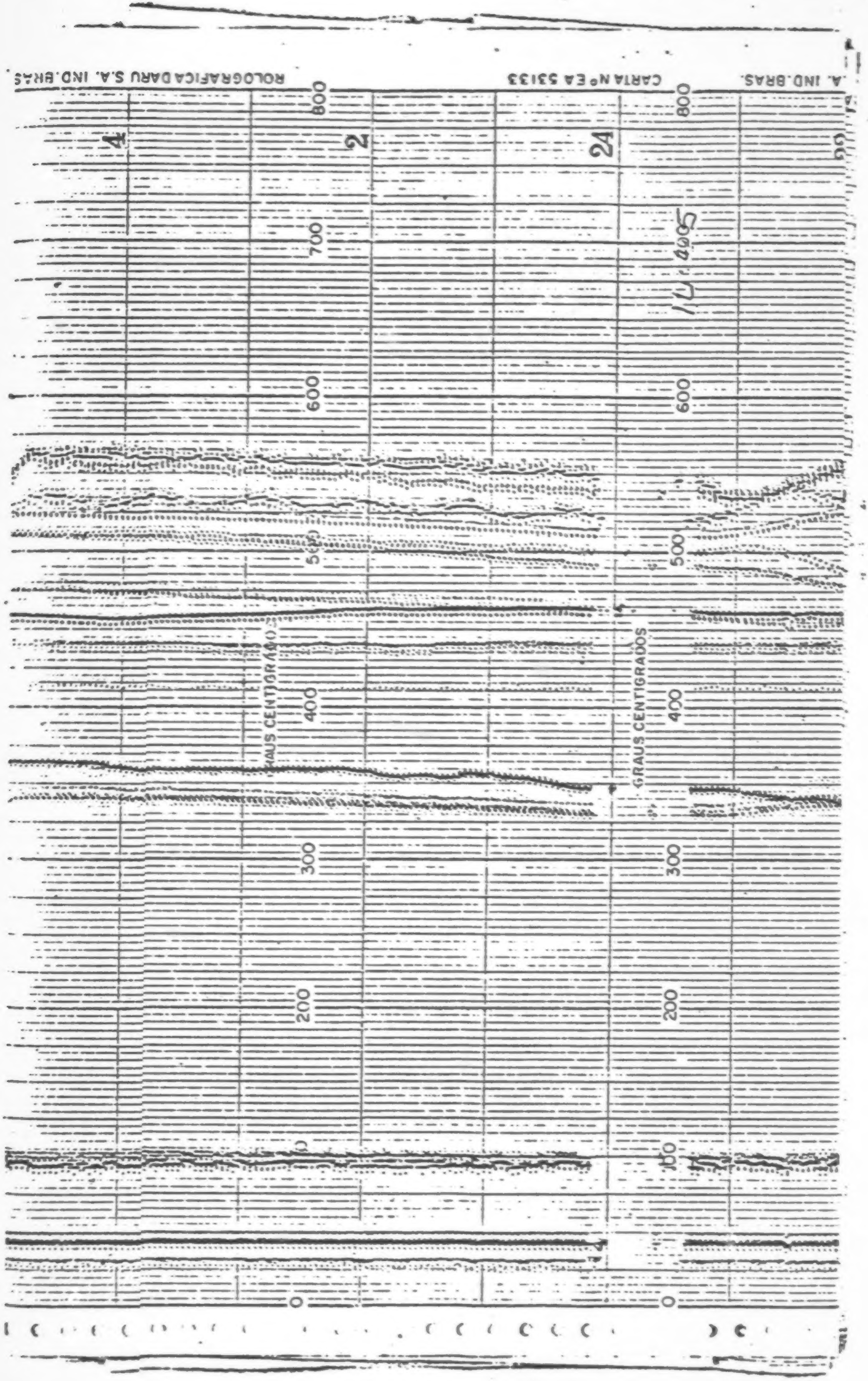
OIL BURNER CHANGING
OPERATION IN THE
GAS HEATER


ROLOGRAFICA DARU S.A. IND.BRAS.
CARTA Nº EA 53133
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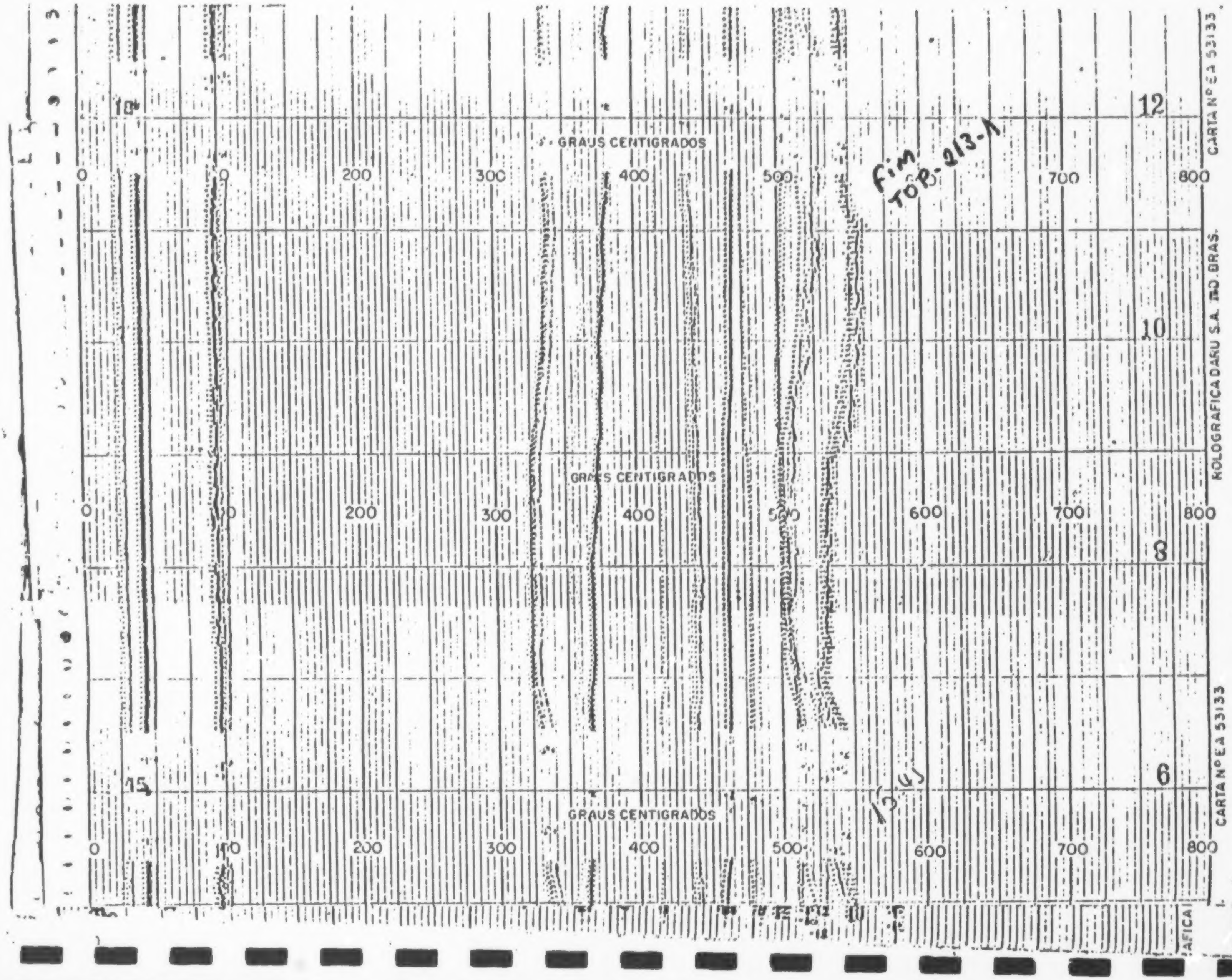
CARTA Nº EA 53133
KOLOGRAFICA DARU S.A. IND. BRAS.
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